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CRETACEOUS CEPHALOPODA FROM PONDOLAND

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With 11 plates and 22 text-figures.

IN September of 1919 the Transvaal Museum sent an expedition to Pondoland under the charge of the writer, with the object to investigate the cretaceous deposits which were known to occur at the mouth of the Umzamba river, and those to the north and to the south of this locality.

The northernmost patch of cretaceous beds was discovered near the mouth of the Hlangeni-nkulu, on the Natal coast. The rock, outcropping at sea-level, is a hard, shelly, sandy limestone. For collecting purposes this rock is very unpromising. The only other locality visited is that of the Umzamba mouth. About ten minutes walk northwards from the mouth of the Umzamba the first outcrops of the cretaceous formation are found. They form here high cliffs, which in some places may be 100 feet high. The cliffs become lower and lower towards the north and they disappear at a distance of about 500 yards from their southern end. These cliffs are underlain by a hard, sandy, shelly limestone, which extends horizontally into the sea. These hard limestones can only be examined at low tide. They prove to be essentially similar to the hard limestones at the mouth of the Hlangeni-nkulu. Hereby I do not wish to indicate, that the limestones in these two localities are on exactly the same horizon, for the simple reason, that petrographically identical layers occur, as far as could be ascertained, throughout the whole thickness. Stratigraphically, however, the beds at the Hlangeni-nkulu resemble the lower beds at the Umzamba in the fact, that the shelly limestones at the northern locality are separated by thin banks of so-called soft material, just as the lower shelly limestones at the Umzamba. The shelly limestones at the Umzamba above the horizontal sea-shelf may have a thickness of a foot or perhaps two feet, but they are separated by banks of "soft material" which have a thickness of from six to seven feet and perhaps more. There seems to be a kind of transition between the lower and the upper beds. The so-called "soft material" is only superficially soft. The banks consist of a flint-hard, blue, compact, very sandy limestone. The sand in this rock, however, seems to be predominant and it might be more appropriate to call it a sandstone kitted with lime. The rock is fine grained and weathers to a soft, fine, blackish sandstone; sometimes the weathered rock is yellow; this may be due to an inconstant small amount of clay.

The sea-shelf of the lower shelly limestones is continued along the coast up to half-way to the mouth of the Umtamvuna. This end is strewn with large blocks of fossil wood, and fossil trees of twenty and thirty feet length are nothing out of the common. Fairly high hills slope steeply towards the beach along this portion, and it is not impossible that patches of cretaceous deposit are still present below the sand and vegetation of these slopes.

There are two high cliffs on the southern bank of the Umzamba, one more towards its mouth and the other more inland, to the west of the waggon road. In the upper part of these cliffs the banks of compact limestone are thick, but in the beds at their foot the compact limestones are much thinner, dwindling to two feet and less for those between high and low water. Further up the Umzamba on the north bank, there is another cliff, which is formed by Table Mountain Sandstone. This formation also crops out on the extreme end of the southern bank of the river. Only about 100 yards to the south of the river, on the sea-beach, cretaceous beds outcrop below sea-level. The coast was not investigated further southwards.

Altogether some 10,000 fossils have been collected here by the expedition, and the following is a description of the cephalopoda contained in this collection. To this have been added the undescribed cephalopoda, which were bought from Mr J. Venter, who collected at the same locality. The other material is still being developed from the matrix, and will be described group-wise as soon as a group is more or less complete.

NAUTILOIDEA.

Genus NAUTILUS Breyn.

Nautilus Woodsi n.sp. Pl. I, figs. 1—3.

The collection contains two nautilus specimens, which have been bought from Mr Venter. They were not described before, because I wanted to await the results of our Pondoland expedition. However, no further specimens have been found. The two specimens belong apparently to the same species. The small specimen, which is in good preservation, is taken as the type.

Shell sub-globose, without umbilicus. Greatest thickness between one-third and one-fourth of the height of the last whorl. Height of last whorl somewhat less than its thickness. Last whorl indented to about two-fifths of its height. Periphery convex and rounded; sides less convex. Umbilical depression filled with a shelly columella.

Surface of shell covered with very fine, close-set growth-ridges, which bend gently forwards in passing from the umbilical region to the sides of the shell, and afterwards curve more rapidly backwards in passing on to the periphery, where they form a broad rounded sinus. The surface of the last half of the whorl is also very inconspicuously undulating. Very broad and extremely low, heightened zones cross the shell in the same direction as the growth-ridges; these zones are separated by broader interspaces. The shell of the last portion of the last whorl is not preserved, but the cast, which is otherwise smooth, shows two far apart shallow grooves, which have the same shape as the growth-ridges. Sipho and sutures are not visible in the type.

The paratype is badly preserved. One side has completely disappeared and the shell of the other side is weathered so badly, that nothing can be said of the ornamentation. However, as far as can be made out, it agrees well with the above description. As in the type, a large portion of the body-chamber is present. However, the sipho is seen in the damaged preceding portion; it lies apparently a little above the centre. The sutures of this specimen are straight. They are straight on the flanks and they do not deviate from their course over the periphery. They are perhaps very slightly convex forwards near the umbilicus. The extreme end of the last whorl is not rounded as its preceding portion, but nearly flat.

Measurements:

	Type	Paratype
Diameter	60 mm.	168 mm.
Height of last whorl ...	35 ,,	about 100 ,,
Thickness of last whorl	41–42 ,,	

41 is the actual thickness of the last whorl and 42 the probable.

I do not see any difference between this species and the specimen described by WOODS from the same locality but not named (**17**, p. 330, fig. 1). The only difference of importance seems to be the presence of a funnel-shaped umbilical depression. The present species differs from *Nautilus elegans* d'Orbigny in its different ornamentation and by the more central position of its siphuncle. Our cretaceous literature is far from complete and the necessary comparison with described forms can only be made to a limited extent. There is not one specimen, described in the literature listed hereafter, with which our species can be confounded.

I have much pleasure in naming this species after Woods, who was the first to describe and figure it, but whose material was not sufficiently well preserved to allow him of giving it a name.

AMMONOIDEA.

Genus PHYLLOCERAS Suess.

Phylloceras Woodsi n.sp. Pl. II, figs. 1—6, text-fig. 1.

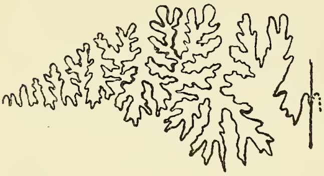
1906. *Phylloceras* sp. Woods. **17**, p. 331, Pl. XLI, fig. 4.

Shell discoidal, umbilicated. Whorls strongly involute, high and narrow. Greatest thickness midway between the umbilical edge and the middle of the flanks. External surface strongly convex. Flanks very slightly convex and only slightly convergent towards the periphery. There is no line of demarcation between flanks and external surface. The portion of the flanks internal to the greatest of the whorl, slopes very gradually towards the umbilical surface, which is very low and strongly convex and the inner portion of which slopes outwards; consequently the radius of the umbilical suture is longer than that of the innermost portion of the umbilical surface. The involution is such, that only an extremely narrow strip of the preceding whorl remains uncovered.

The ornamentation consists of numerous, crowded, thin, wire-like ribs. On the outer third of the whorl these ribs are distinctly coarser than on the inner two-thirds. The coarse portion of the ribs is straight and they pass without deviation over the external surface. In their coarse portion the ribs are high, narrow and rounded and have steep sides. On the middle of the flanks the ribs are slightly convex forwards; internal to the middle of the flanks they run backwards, in the direction of the umbilical edge; on the inner third of the flanks they are concave forwards and they pass over the umbilical edge in a slightly forward direction. The inner two-thirds of the ribs are very low, narrow and rounded, and their sides have a moderate inclination.

There are broad, shallow grooves, starting at the umbilical edge and completely disappearing before reaching the middle of the flanks. Six of these grooves are present on the last whorl. They probably indicate old mouth-edges, for it seems as if each corresponds with a slightly broader interspace between the ribs on the outer portion of the flanks and the external surface. The direction of the broad grooves is the same as that of the ribs.

The lobe-line is phylloid. This is not very clear in the text-figure, because the rounded terminations of the lobe-line are very delicate and easily suffer when the shell is treated with acid. They are, however, well visible in other lobe-lines shown in fig. 1, Pl. II. The lobe-line is of the greatly complicated type of the younger forms of the genus *Phylloceras*. On a radius of 9 mm. there are nine saddles, this number being also present on a radius of 25 mm. Most of the lobes are irregularly trifid, and the first lateral lobe has a large posterior development. The external lobe is short and this, together with the great size of the external branch of the first lateral lobe, gives the external saddle the appearance of overhanging the first lateral lobe. The first lateral saddle is the largest. The saddles diminish regularly in height from here to the umbilicus, in such a way, that a line touching their anterior ends is practically straight. This is also the case with a line touching the posterior ends of the auxiliary lobes. The whole of the auxiliary portion runs very slightly backwards. The second lateral lobe is somewhat longer than the first auxiliary lobe. The external saddle, both lateral saddles and two auxiliary saddles are symmetrically divided by secondary lobes. On the last whorl of the largest specimen the second lateral saddle and first auxiliary saddle show a tendency of becoming trifid.


Text-fig. 1. *Phylloceras Woodsi*. Lobe-line of type up to the umbilical edge on a radius of 9 mm. Nearly ×4½.

Measurements:

	Type	Paratype	Paratype
Diameter	24·5 mm. (1·00)	46 mm. (1·00)	20·3 mm. (1·00)
Height of last whorl ...	14·6 ,, (0·60)	28 ,, (0·61)	11·7 ,, (0·58)
Thickness of last whorl ...	7·4 ,, (0·30)	13·2 ,, (0·29)	6·4 ,, (0·32)
Height of penult. whorl ...	4·9 ,, (0·20)	9·7 ,, (0·21)	3·7 ,, (0·18)
Thickness of penult. whorl	3·3 ,, (0·13)	4·8 ,, (0·10)	2·9 ,, (0·14)
Diameter of umbilicus ...	2 ,, (0·08)	2·8 ,, (0·06)	1·8 ,, (0·09)

The type has suffered slightly and the large specimen somewhat more from crushing.

Of the Indian forms *Phylloceras Nera* stands very near to the South African type. The general appearance of the two forms is strikingly similar. There is, however, a slight difference in the shape of the whorl and in the shape of the ribs. The grooves of the old mouth-edges are also different. The differences of the lobe-line are, however, striking. In *Phylloceras Nera* the auxiliary portion of the lobe-line runs more and more backwards, that is to say, both, the line touching the anterior ends of the saddles and the one touching the posterior ends of the lobes, are convex forwards, whereas in our form the first line is straight up to the first lateral saddle and the second up to the second lateral lobe. The lobe-line, text-fig. 1, has been taken on practically the same radius as that given by Kossmat of *Phylloceras Nera* (**12**, Pl. II, fig. 2 *d*). In *P. Nera*, however, the distance of the axis of the first lateral lobe, taken from a point between the tips of the two large secondary saddles, to the umbilicus, is 1·84 times the height of the first lateral saddle above the posterior end of the first lateral lobe, whereas in our form the first measurement is only 1·3 times the second.

There seems to be a greater resemblance even with *Phylloceras Velledaeformis* Schlüter sp. (**6**, S. 60, Taf. XVIII, figs. 4, 5, 7). There is the same general appearance and a similar ornamentation. Especially the lobe-line is strikingly similar. The first lateral lobe has a large external branch in both species. The auxiliary saddles of *P. Velledaeformis* also seem to stand in a straight line. However, *P. Velledaeformis* does not show any old mouth-edges, the external portion of its ribs, which only cover a portion of the shell, leans forwards, while the ribs of *P. Woodsi* cover the whole shell and their external portion is radial. There is also difference in the shape of the whorls. The specimen mentioned by Woods (**17**, p. 331, Pl. XLI, fig. 4 *a—c*) has the same shape and sculpture. The beautiful lobe-line given by Woods is essentially the same as that of our form given in text-fig. 1, the only difference being, that Woods' specimen shows less auxiliary saddles. This is probably from its being taken on a smaller radius. I do not, therefore, doubt that this specimen belongs to the present species, which I have much pleasure in naming after Woods. PERVINQUIÈRE, however, is convinced that WOODS' figures represent a specimen of *P. decipiens* Kossmat (**18**, p. 56), because shape, ornamentation and lobe-line are so clearly the same. *P. decipiens* has a much larger umbilicus than *P. Woodsi* and also than the specimen figured by Woods. The flanks of *P. decipiens* converge strongly towards the periphery, those of *P. Woodsi* and WOODS' specimen are only slightly convergent in that direction. *P. decipiens* does not show indications of old mouth-edges. The lobe-line of *P. decipiens* differs especially from that of *P. Woodsi* and Woods' specimen in the very much shorter external lobe.

The collection contains five specimens of this species, one of which has been chosen as the type.

Genus GAUDRYCERAS de Grossouvre.

Gaudryceras tenuilineatum n.sp. Pl. II, figs. 7—9, text-fig. 2.

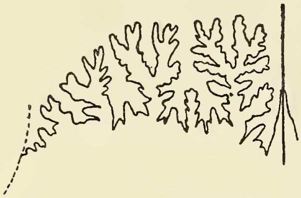
Shell discoidal, umbilicated, consisting of numerous whorls. Whorls broader than high and increasing slowly in size. Greatest thickness of last whorl in the middle of the flanks; that of the penultimate whorl lies slightly more towards the external surface. External surface convex and very broad. The external surface seems to be less convex at the beginning of the last whorl than at its end. Lateral surface of whorls strongly convex and narrow. Umbilical surface also convex. The sides of the whorl round off evenly into the periphery surface and into the umbilical surface. Involution one-third, that is to say, one-third of the height of the penultimate whorl is embraced by the last whorl. Umbilicus large.

The ornamentation of the shell is extremely fine, so fine, that it is only visible with a magnifying glass. To the naked eye the shell has a silky sheen. The ornamentation consists of numerous, very fine, crowded hair-ribs. Many of these ribs start at the umbilical suture, others are intercalated at a short distance from the suture, while some even start on the middle of the flanks. They all cross the external surface. The distance separating them is usually slightly greater than their breadth. Sometimes, however, they are much closer together. They also pass over the thick ribs of the old mouth-edges. Between the diameters of 9 mm. and 11 mm. there are about 130 of these ribs to a chord of 1 cm.

The ribs are for a short distance perpendicular to the umbilical suture. They then bend strongly forwards, which direction changes gradually to nearly radial on the middle of the flanks; further outwards the ribs again bend forwards to form a broad and very short, tongue-shaped, forward convexity on the external surface.

There are four old mouth-edges on the last whorl, which follow the same course as the ribs, and which present themselves as a sulcus bordered behind by a thick, broad rib.

The lobe-line is typically that of *Gaudryceras*. The external lobe is very narrow and longer than the first lateral lobe. It is symmetrically divided by a very narrow siphonal saddle, the anterior end of which nearly reaches the radius through the anterior end of the secondary saddle in the first lateral lobe. The external saddle and both lateral saddles are more or less symmetrically divided by a secondary lobe. There are four auxiliary saddles at the end of the last whorl. From the first lateral saddle the lobe-line runs backwards and inwards and the radius of its crossing point with the umbilical suture lies behind that of the posterior end of the external lobe. The second lateral lobe stands obliquely, that is to say, is directed forwards and inwards.



Text-fig. 2. *Gaudryceras tenuilineatum*. Lobe-line of type up to the umbilical suture on a radius of 14 mm. × 3·4.

Measurements:

Diameter	26·5 mm.	(1·00)
Height of last whorl	7·3 ,,	(0·28)
Thickness of last whorl ...	10·8 ,,	(0·41)
Height of penultimate whorl ...	4·3 ,,	(0·16)
Thickness of penultimate whorl	7·6 ,,	(0·29)
Diameter of umbilicus... ...	13·4 ,,	(0·51)

If the last whorl were removed, the shell would have a diameter of 15 mm. or at the most 16 mm. The relative dimensions would then be:

Diameter	15 mm.	(1·00)	16 mm.	(1·00)
Height of last whorl ...	4·3 ,,	(0.29)	4·3 ,,	(0·27)
Thickness of last whorl	7·6 ,,	(0·51)	7·6 ,,	(0·47)
Diameter of umbilicus	8·6 ,,	(0·57)	8·6 ,,	(0·54)

This new species differs from *Gaudryceras Sacya* Forbes sp. by the shape of its whorls. In the young stages the whorls of *G. Sacya* are round, according to Kossmat and Stoliczka, while the whorls of *G. tenuilineatum* are much broader than high. The whorls of *Gaudryceras multiplexum* Kossmat have a different shape and the ornamentation of this species is much coarser. The young whorls of *G. varagurense* Kossmat have a different shape and the ornamentation of this species is also coarser. There is great resemblance between *G. tenuilineatum* and *G. subtililineatum* Kossmat. The whorls of both increase slowly in size and are much broader than high; the involution is in both species the same and the sculpture of both is invisible to the naked eye. The difference between the two forms lies in the fact, that the whorls of *G. subtililineatum* increase quicker in size than those of the African form. This difference is apparent when the specimen of *G. tenuilineatum* is compared with Kossmat's figure of *G. subtililineatum* (**12**, Pl. XIX, fig. 2). If our form at a diameter of 15 to 16 mm. is compared with the measurements of a specimen of *G. subtililineatum* of the same diameter, it will be seen that the whorls of our form are relatively thicker. These differences made it necessary to keep the two forms separate. However, there is still some doubt, caused by the impossibility of comparing the two forms in all characters. The state of preservation of the known specimens of *G. subtililineatum* was apparently such, that not all the characters of the species could be studied. The sculpture of all other species seems to be coarser. *Gaudryceras Kayei* Forbes sp. differs also in the relations of its whorls at comparable stages. The whorls of *Gaudryceras valudayurense* Kossmat increase much quicker in size than those of our form.

Only one specimen of this species has been found.

Gaudryceras varicostatum n.sp. Pl. II, figs. 10—12, text-figs. 3, 4.

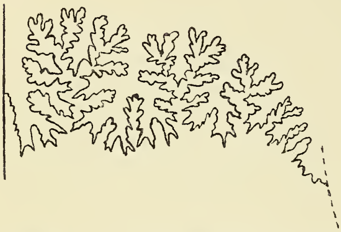
Shell discoidal. Whorls broader than high, but the height increasing more rapidly than the breadth. Greatest thickness at the umbilical edge. The sides of the whorl round off evenly into the peripheral surface; they also round off into the umbilical surface, that is to say, there is no real umbilical edge, the surface is only more convex in this region. This shape of whorl is present even in the youngest whorls visible, from a diameter of 5 mm. upwards. External surface of older whorls broadly convex, of last whorl narrower and more convex. Lateral surface of last whorl less convex than of preceding whorls. Umbilical surface of last whorl steeper than of the preceding whorls. Involution moderate. The last whorl embraces less than two-fifths of the height of the preceding one. Umbilicus large.

The ornamentation of the shell varies from the umbilicus outwards. The umbilical surface is covered with fine, wire-like ribs, which mostly start at the umbilical suture and which pass on to the flank. Some of them, on the older whorls, do not start at the umbilical suture, but slightly away from it. At the middle of the flank these ribs flatten out and nearly disappear. On the older whorls it is seen, that the flattening begins just before the ribs are covered by the next whorl. Some of the ribs bifurcate before reaching this point. At the end of the last whorl these wire-like ribs cover the flank completely and they only leave a comparatively narrow peripheral surface for the hair-ribs. Where the ribs are flattened out they correspond with three, four or five finer ribs, which can only just be seen with the naked eye. Most of these finer ribs start at the extreme end of the coarser ones, but some are intercalated between them. They are very short, in fact, they do not get out of the zone of the umbilical suture. To the naked eye the external surface seems to be smooth. This, however, is not so, for with a glass magnifying about ten times one can clearly see, that it is covered with numerous, close-set, extremely fine ribs. On the external surface of the last whorl these ribs have been removed by weathering. On the beginning of the last whorl there are about 100 of these ribs to a chord of 1 cm. Opposite the place where these were counted there were about 28 coarse ribs at the umbilical suture on a chord of the same length.

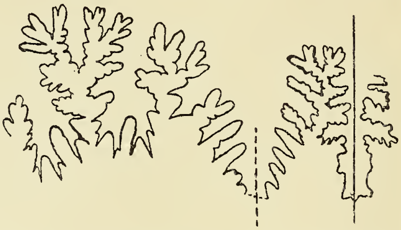
Starting from the umbilical suture the coarse ribs are directed slightly forwards and in passing on to the flank they bend more forwards. They are therefore concave towards the front. On the flank the coarse ribs and the short flank-ribs are slightly convex forwards. The very fine ribs are slightly concave forwards at their beginning on the flank and rather strongly convex forwards on the external surface.

There are four sulci on the last whorl, which follow the same course as the ribs. These sulci are bordered behind by a thickening of the shell.

The lobe-line is typically that of the genus *Gaudryceras*. The external lobe is narrow and has the same length as the first lateral lobe. It is symmetrically divided by a narrow siphonal saddle, which is not longer than the secondary saddle in the first lateral lobe. The external saddle and both lateral saddles are more or less symmetrically divided by a secondary lobe. The second lateral saddle lies partially on the umbilical edge. At a diameter of from 31—39 mm. there are from five to six auxiliary saddles. The narrow dorsal lobe runs far backwards on the umbilical suture; it could not be made out whether it ends in a point or not. The dorsal saddle is narrow and like the lateral saddles divided by a secondary lobe. Its inner side is parallel to the axis of the antisiphonal lobe and its outer side runs from the bottom of the dorsal lobe forwards and inwards, therefore not parallel to its inner side. The antisiphonal lobe is very narrow and very long. The end, posterior to the posterior pair of transverse lobules, is very long and terminates in a point. The axes of the lobules, of which there are three pairs, stand practically at right angles to the axis of the lobe. The antisiphonal lobe is nearly as long as the dorsal lobe.



Text-fig. 3. *Gaudryceras varicostatum.* Lobe-line of type up to the umbilical suture on a radius of 18 mm. About ×3.



Text-fig. 4. *Gaudryceras varicostatum.* Partial lobe-line of type from the first lateral lobe up to the dorsal lobe on a radius of 23 mm. ×3.

Measurements:

Diameter	39·6 mm.	(1·00)
Height of last whorl	13·7 ,,	(0·35)
Thickness of last whorl ...	14·7 ,,	(0·37)
Height of penultimate whorl ...	6·2 ,,	(0·16)
Thickness of penultimate whorl	8·2 ,,	(0·21)
Diameter of umbilicus... ...	17·2 ,,	(0·43)

Most characteristic for the new form is its sculpture. The increase in size of the whorls is also peculiar. It differs from *Gaudryceras Sacya* Forbes sp. especially through its ornamentation; the shell of *G. Sacya* is covered with fine hair-ribs only. There is, however, a great resemblance between the two forms in the dimensions and the increase in size of the whorls. *Gaudryceras varicostatum* differs from *G. multiplexum* in the shape of the whorls and in the varied costation. It seems, however, that in younger whorls the ornamentation tends to approach that of *G. multiplexum*, although the longer coarse ribs on the end of the last whorl in our form are closer together than those of *G. multiplexum*. The involution of the two forms is about the same. *Gaudryceras varagurense* Kossmat is more involute, while the flanks of its younger whorls are flattened. Its ornamentation is also different. *Gaudryceras Kayei* Forbes sp. has a different ornamentation, a different shape of whorl and a relatively wider umbilicus. *Gaudryceras vertebratum* Kossmat has a different shape of whorl. I do not see any difference with the specimen named *Ammonites Kayei* by Griesbach (**5**, p. 63) and figured by Woods (**17**, Pl. XLI, figs. 8, 8 *a*). It cannot be made out with certainty, because the specimen has not been described. Griesbach only mentions a few old mouth-edges and flexuous ribs, which are very fine and narrow, and generally divided into two or three at about the middle of the whorls. Prof. Dr G. Gürich, the director of the Mineralogisch-Geologisches Institut of Hamburg, kindly sent me casts of GRIESBACH's specimen, and these place it practically beyond doubt, that this specimen belongs to the present species.

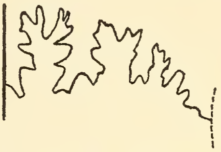
Only one specimen of this species has been found.

Gaudryceras Sigcau n.sp. Pl. II, figs. 13—16, text-fig. 5.

Shell discoidal, umbilicated, consisting of many whorls, which at first increase slowly and afterwards more rapidly in size (both specimens have at least five whorls at a diameter of 11 mm.). Greatest thickness of last whorl internal to the middle of the flanks; of the preceding whorl on the middle of the flanks. Sides of whorl and external surface convex. There is no demarcation between the external surface and the flanks. The convexity is slightly increased between the flanks and the umbilical surface. Umbilical surface sloping inwards from the flanks. Involution about one-half.

The ornamentation of the shell is extremely fine and practically invisible to the naked eye. It consists of numerous, very fine, narrow, low, line-like ribs. I do not call these ribs hair-like or thread-like, because they differ from those of *Gaudryceras tenuilineatum* for example. The interspaces between the ribs are flat and of irregular breadth but always much broader than these. The ribs are slightly concave forwards on the umbilical surface and on the umbilical edge. They run slightly forwards on the flanks, are slightly convex forwards on the middle and very slightly concave forwards on the external portion of the flanks, while they are again very slightly convex forwards on the external surface. Old mouth-edges have not been noticed.

The lobe-line is a typical *Gaudryceras* one. The external lobe is narrow and has the same length as the first lateral lobe. The external saddle and the first lateral saddle are both symmetrically divided by a secondary lobe. The second lateral saddle is unsymmetrical. Both lateral lobes and the first auxiliary lobe are bifid. The outer portion of the first lateral lobe is bigger than the inner portion. At a diameter of 4·5 mm. there are three auxiliary saddles. From the first lateral saddle the lobe-line runs backwards and inwards towards the umbilical suture.



Text-fig. 5. *Gaudryceras Sigcau.* Lobe-line of paratype up to the umbilical suture on a radius of 4·5 mm. ×7.

Measurements:

	Type	Paratype
Diameter	11·6 mm. (1·00)	11·1 mm. (1·00)
Height of last whorl	4·6 „ (0·40)	4·7 „ (0·42)
Thickness of last whorl ...	4·5 „ (0·39)	4 „ (0·36)
Height of penultimate whorl	2 „ (0·17)	2 „ (0·18)
Thickness of penultimate whorl	3 „ (0·26)	2·9 „ (0·26)
Diameter of umbilicus ...	3·9 „ (0·34)	4 „ (0·36)

This pretty little ammonite is easily distinguished from many of the Indian *Gaudryceras* species. The height of the whorls surpasses the breadth quicker in our form than in most of the Indian ones. The relations of our form differ markedly from some other Indian species. *Gaudryceras involvulum* Stol. sp. and *G. revelatum* Stol. sp., show differences in the lobe-line. *G. politissimum* Kossmat differs in shape, number of whorls and in the lobe-line. *G. odiense* Kossmat has a different shape. *G. varuna* Forbes sp. differs in shape and lobe-line. *Gaudryceras leptonema* Sharpe sp. (**2**, p. 32, Pl. XIV, fig. 3) differs in shape and number of whorls. *Gaudryceras Rouvillei* de Gross. (**10**, p. 228, Pl. XXXVII, figs. 7, 10) shows differences in the lobe-line. Comparison with the Japanese species of *Gaudryceras* is difficult, because our specimens are very small, while the Japanese species are mostly known by large specimens. It seems, however, that our form has a number of whorls at a given diameter, which exceeds that of some Japanese species. It differs from nearly all of them through its fairly large umbilicus and its rapid increase in size. Another question to be dealt with is, whether the present specimens are or are not young stages of known Pondoland forms. *Gaudryceras amapondense* v. Hoepen (**20**, p. 143, Pl. XXIV, figs. 4, 5) is the only species which warrants the question. Its young stage, however, shows a large umbilicus and slowly increasing whorls. The dimensions show different relations.

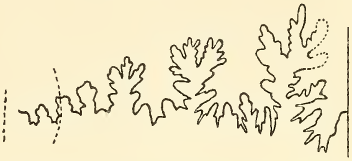
Two specimens of this species have been found. Named after the former Pondoland chief SIGCAU.

Genus TETRAGONITES Kossmat.

Tetragonites superstes n.sp. Pl. II, figs. 17—20, text-fig. 6.

Shell discoidal, umbilicated, consisting of a few thick whorls. Whorls broader than high. Greatest thickness at, or slightly internal to the middle of the flanks. Sides of whorl and external surface slightly convex. The shell is strongly convex between the external surface and the flanks. Umbilical surface vertical to the plane of symmetry and of moderate height. There is no sharp line of demarcation between the umbilical surface and the flank, but the two surfaces pass very abruptly into each other. Involution two-thirds.

The ornamentation of the shell is very delicate. The external surface and the greater part of the flanks are apparently smooth both in the type and in the paratypes. However, large portions of the shell are lost in the type and it is not impossible that extremely fine growth-lines have been worn away on the parts most exposed. The shell of the paratypes is well preserved. The umbilical surface and the internal part of the flanks is covered in two specimens by very fine, closely set growth ridges, which are only visible with a magnifying glass and which have the same course as the mouth-edges. Further the shell is ornamented with some, apparently five, spiral ridges. These ridges are only visible on most of the last whorl of the type and on the last quarter of the last whorl of another specimen and on half the last whorl of a third specimen, the smallest of the three. They are very low, in fact only just distinguishable. One of these ridges follows the medial line of the external surface. Two others are on each side of the shell on the very convex surface between the external surface and the flanks. The type is complete up to its last apertural edge. The umbilical portion of this edge stands practically vertical on the umbilical suture. On nearing the edge of the umbilicus it leans slightly forwards and, on passing over the edge it is directed strongly forwards, to such an extent as to nearly form a tangent to the spiral of the umbilical edge. On the flanks the mouth-edge is quite straight. On the junction between external surface and flanks the edge turns, so as to pass transversely over the external surface. The edge is slightly concave forwards on the middle of the external surface. The mouth-edges are represented by grooves on the cast. On the shell they are visible as very slight ridges; these ridges are so slight, that they can easily be overlooked. I can only find two old mouth-edges in the type; these are on the living chamber and fairly close together. On another specimen, of which a portion of the living-chamber is preserved, four old mouth-edges are clearly visible on about half of the last whorl. The complete living-chamber of the type-specimen, the first complete one known of *Tetragonites*, occupies three-fourths of the last whorl. The smallest specimen of the three is also complete and its living-chamber may also extend over three-fourths of the last whorl.



Text-fig. 6. *Tetragonites superstes*. Lobe-line of type up to near the umbilical suture on a radius of 13 mm. ×3.

The lobe-line is essentially that of *Tetragonites Timotheanus* Mayor sp. The saddles diminish in size from the external one inwards. The lobe-line is built on a nearly straight axis, that is to say, the umbilical portion of the lobe-line only runs very slightly backwards. The external saddle and both lateral saddles are trifid. The lobes are fairly broad. The external lobe is slightly longer than the first lateral one; the lobes become gradually shorter towards the umbilical suture. There are four auxiliary lobes.

Measurements:

	Type		Paratype	
Diameter	40 mm.	(1·00)	32·4 mm.	(1·00)
Height of last whorl	17·3 ,,	(0·43)	14·2 ,,	(0·44)
Thickness of last whorl ...	18·2 ,,	(0·46)	15·5 ,,	(0·48)
Height of penultimate whorl	9·3 ,,	(0·23)	7·2 ,,	(0·22)
Thickness of penultimate whorl	9·5 ,,	(0·24)	8·3 ,,	(0·26)
Diameter of umbilicus ...	10·4 ,,	(0·26)	8·3 ,,	(0·26)

The present species shows great resemblance to both *Tetragonites Timotheanus* Mayor sp. and *Tetragonites epigonus* Kossmat. The lobe-line, as far as visible, is very much like that of *T. Timotheanus*. In *T. Timotheanus*, however, there are two auxiliary saddles and possibly a minute third one, while in the new form there are three auxiliary saddles and a minute fourth one. Further, in *T. Timotheanus* the first auxiliary saddle lies on the edge of the umbilicus, while in *T. superstes* the second auxiliary saddle lies external to or on the umbilical edge. The whorls of *T. Timotheanus* have a somewhat different shape and are relatively thicker than those of the new form. No mention has ever been made of spiral ridges on *T. Timotheanus*; these ridges are visible even on the cast of the new form, and would, therefore, also have been noticed on casts of *T. Timotheanus* if this species had spiral ridges. I take it, therefore, that this is another difference between the two forms.

The lobe-line of the present form differs from that of *T. epigonus* in the fact, that the umbilical portion of the suture only runs very slightly backwards. The first lateral lobe is also relatively broader. The shape of the whorls is different in the two forms and no spiral ridges have been observed in *T. epigonus*. The mouth-edges of both *T. Timotheanus* and *T. epigonus* are more convex forwards near the external surface than in *T. superstes*. The only other species as far as I know, with ridges or lines, is *Tetragonites sphaeronotus* Jimbo sp. It appears from Jimbo's (**11**, p. 35, Pl. VI, figs. 3, 4) and Yabe's (**15**, Pt 1, p. 45, Pl. VII, fig. 1) description, that this species has rounder whorls, and Yabe's figures show the mouth-edges to have a different shape.

Four specimens have been found, one of which has been chosen as the type; two others are well preserved, but the fourth is in bad condition.

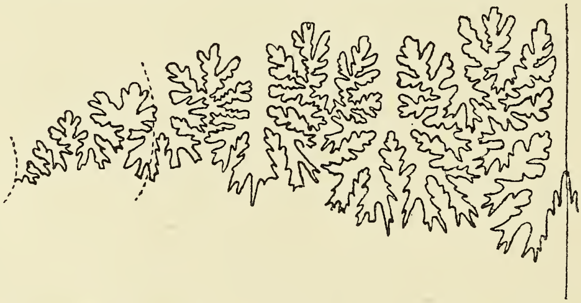
Tetragonites virgulatus n.sp. Pl. III, figs. 1, 2, text-fig. 7.

Shell discoidal, umbilicated, consisting of a few thick whorls. Whorls broader than high. Greatest thickness at or slightly internal to the middle of the flanks. Sides of whorl and external surface convex. The last whorl shows no demarcation between the external surface and the flanks, the section of the whorl, through flanks and external surface being practically circular. The high umbilical surface is nearly vertical to the plane of symmetry, being very steeply inclined towards the centre. There is no sharp line of demarcation between the umbilical surface and the flank, the surface between the two being only strongly convex. Involution nearly two-thirds.

The ornamentation of the shell is very delicate. Practically it is smooth and only covered by growth-lines. With the magnifying glass these growth-lines appear to consist of extremely fine grooves and broad, very low growth-ridges. The grooves are separated by much broader interspaces. This ornamentation is most conspicuous on the umbilical surface, diminishes on the flanks and has nearly disappeared on the external surface. This may have been caused by weathering, for there is practically no difference between the outer surface and the umbilical surface of the paratype. Broader and deeper grooves, which lie fairly close together, cross the shell at irregular intervals. These grooves, separated by the broad interspaces, give the shell, especially on the flanks, a banded appearance, which was accentuated by a difference in colour when the shell had just been cleaned from matrix. After a few days, however, this difference in colour had disappeared. The grooves are nearly perpendicular to the umbilical suture, leaning only slightly backwards. Above the middle of the umbilical surface they bend forwards and they pass over the umbilical edge in a strongly forward direction. However, as soon as they are on the flanks, they bend slightly backwards, in such a way, that they are slightly concave backwards and still retain a slightly forward direction. On the flanks they are practically straight, but on nearing the external surface they again become slightly concave backwards, while they are slightly concave forwards on the middle of the external surface.

Spiral ridges have not been seen in the type, and old mouth-edges could not be found. However, there are indications of spiral ridges on the paratype, and the sipho of this specimen causes a distinct siphonal ridge.

The lobe-line very much resembles that of *Tetragonites epigonus* Kossmat. It is, however, even more complicated and the lobes are narrower than those of the mentioned species. The saddles diminish in size from the external one inwards. The umbilical portion of the lobe-line runs backwards. In *Tetragonites epigonus* this running backwards of the lobe-line starts somewhat further outwards. The external saddle and both lateral saddles are practically trifid. All lobes up to the first auxiliary reach equally far backwards. The second and third auxiliary lobes reach nearly as far backwards as the others. The first



Text-fig. 7. *Tetragonites virgulatus*. Lobe-line of type up to the umbilical suture on a radius of 16 mm. ×3·5.

lateral lobe is beautifully bifid. The second lateral lobe can only be regarded as trifid. The secondary saddle, which could have been the median one, if the lobe had been bifid, stands on the external side of the axis of the lobe and is directed forwards and inwards. There are five auxiliary saddles and six auxiliary lobes.

Measurements:

	Type		Paratype
Diameter	33·5 mm.	(1·00)	Probably about 50 mm.
Height of last whorl	16·7 ,,	(0·50)	26 ,,
Thickness of last whorl	17·1 ,,	(0·51)	27·5 mm.
Height of penultimate whorl	6 ,,	(0·18)	
Thickness of penultimate whorl	7·5 ,,	(0·22)	
Diameter of umbilicus	7·3 ,,	(0·22)	

The new form differs from *Tetragonites superstes* in the lobe-line, the shape of the whorls and the increase in size of the whorls. It is also easily distinguished from *T. Timotheanus*. There is much greater resemblance with *T. epigonus*. However, our form differs from this species in the shape of the whorls, the increase in size of the whorls, the ornamentation and the lack of constrictions and in the lobe-line. Some differences in the lobe-line have already been mentioned. Another difference with the type is the trifidity of the second lateral lobe. This trifidity is, however, also very pronounced in the lobe-line figured by Pervinquière of specimens from Tunis (**18**, p. 76).

This species is based on one beautifully preserved specimen and on an excellent fragment.

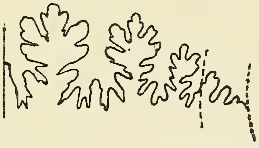
Tetragonites nuperus n.sp. Pl. III, figs. 3, 4, text-fig. 8.

Shell discoidal, umbilicated, consisting of numerous whorls. Whorls increasing slowly in size, and slightly thicker than high. Greatest thickness between the middle of the flanks and the umbilical edge. External surface convex; flanks also convex, but convexity diminishing towards the umbilicus; near the umbilical edge the flanks are nearly flat. There is no demarcation between the external surface and the flanks. The umbilical surface is nearly vertical to the plane of symmetry and of moderate height. The umbilical surface passes very abruptly into the flank, thus forming a rounded umbilical edge. Involution one-third. Umbilicus large.

The ornamentation of the shell is very delicate; it has mostly disappeared through decortication. The umbilical surface is covered with very fine ribs which are only visible with the help of a magnifying glass. They start vertically on the umbilical suture, but they very soon commence to lean forwards and they pass over the umbilical edge in a strongly forward direction. On the flanks and on the external surface they are represented by very fine growth-lines and grooves, which have the same direction as the old mouth-edges. Very slight spiral ridges are visible on the cast of the outer portion of the flank. I did not find indications of these ridges on the preserved portions of the shell of the type, but they are present on a preserved portion of the shell of paratype No. 1.

Old mouth-edges are not only visible on the last whorl of the type, but also on all the other specimens. Even the smallest shows a mouth-edge at a radius of 5 mm. They are less conspicuous or totally invisible on the earlier whorls of the type. They start at the umbilical suture leaning very slightly forwards, and they pass over the umbilical edge in a strongly forward direction. The whole of the mouth-edge on the flanks is slightly convex forwards. This convexity is retained on passing on to the external surface. The mouth-edge is very slightly concave forwards on the middle of the external surface, the concavity being so slight, that one is sometimes in doubt, whether to regard the mouth-edge here as straight or not. The mouth-edges appear as grooves on the cast and as very slight ridges on the shell. There are six old mouth-edges on the last whorl of the type.

The lobe-line resembles very much that of *Tetragonites Cala* Forbes sp. The external saddle is the largest. The external lobe is of the same length or perhaps slightly longer than the first lateral lobe. The second lateral lobe reaches nearly as far backwards as the first. The three principal saddles are trifid. The two incisions in the anterior portion of the external saddle have practically the same length. In the first lateral saddle the external of the two incisions is longer than the internal one and in the second lateral saddle the internal incision lies nearer to the middle of the front of the saddle than the external one. The first lateral lobe is symmetrically bifid. The second lateral lobe may also be called bifid, but it is not symmetrical, for the secondary saddle at the base of the lobe is directed strongly inwards. The second lateral saddle lies completely external to the umbilical edge, which just touches the external side of the first auxiliary saddle. The auxiliaries are very small. There are four auxiliary lobes and saddles, the last auxiliary lobe and saddle being mere undulations of the lobe-line. A contour line over the posterior ends of the lobes is fairly straight and its umbilical portion does not run backwards. A contour line over the anterior ends of the saddles, however, is not straight, because its whole portion internal to the first lateral saddle bends backwards on its outer portion.



Text-fig. 8. *Tetragonites nuperus.* Lobe-line of type up to the umbilical suture on a radius of 13 mm. ×3.

The above is the description of the lobe-line of the type on a radius of 13·7 mm. The smallest specimen present shows its lobe-lines beautifully and one of them, on a radius of 5 mm. has been chosen for comparison. The external lobe of this lobe-line is longer than the first lateral lobe, the length of the latter being about three-quarters of that of the former. The external saddle is symmetrically trifid. The anterior border of the first lateral saddle shows two slight indentations, of which the external one is deeper than the other. The anterior border of the second lateral saddle is more or less evenly rounded. The umbilical portion of the lobe-line shows three small saddles, which are really nothing more than slight undulations. The two lateral lobes are bifid and the secondary saddle at the base of the second lateral lobe is placed unsymmetrically. At a radius of less than 3 mm. there is only one auxiliary undulation (saddle).

Measurements:

	Type	Paratype No. 1	Paratype No. 2
Diameter	37·6 mm. (1·00)	25·5 mm. (1·00)	15 mm. (1·00)
Height of last whorl ...	14 ,, (0·37)	9 ,, (0·35)	5·6 ,, (0·37)
Thickness of last whorl ...	15·4 ,, (0·41)	10·2 ,, (0·40)	6 ,, (0·40)
Height of penult. whorl ...	7 ,, (0·19)	4·5 ,, (0·18)	2·8 ,, (0·19)
Thickness of penult. whorl	7·6 ,, (0·20)	5 ,, (0·20)	3 ,, (0·20)
Diameter of umbilicus ...	15·5 ,, (0·41)	10·6 ,, (0·42)	6·2 ,, (0·41)

Paratype No. 2 has suffered from pressure.

Tetragonites nuperus belongs to the group of *Tetragonites Cala* Forbes sp. It is easily distinguished from this species through the following characters: *T. Cala* has whorls of trapezoidal section; its involution is about one-seventh;

its mouth-edges have a different shape; the umbilical portion of its lobe-line runs backwards (that is, also the contour line over the posterior ends of the lobes); the saddles are narrow and the lobes are broad, whereas in *T. nuperus* this is the reverse. There is great resemblance between our form and *Tetragonites Kingianus* Kossmat. Nothing much can be said of the lobe-lines, since the two lobe-lines given by Stoliczka of *Amm. Cala* Forbes (**4**, Pl. LXXV, fig. 4 *b* —we do not possess Forbes' paper) show considerable differences among each other. Both agree, however, in the running backwards of their umbilical portion, and this is not the case in our form. There is a remarkable difference in the direction and shape of the mouth-edges. The mouth-edges of *T. Kingianus* are straight on the flanks, those of our form are convex forwards. In *T. Kingianus* they are directed much more forwards than in *T. nuperus*. The mouth-edges of the Indian form make an angle of about 70° with a radius of the spiral through their starting point on the umbilical suture, while this angle in *T. nuperus* is not larger than 50°. Pervinquière (**18**, p. 78) referred a small *Tetragonites* with doubt to *T. Kingianus* and it is not impossible, that his *Lytoceras* (*Tetragonites*) aff. *L. Kingianum* Kossmat, of which he enumerates the differences with the type and which shows great resemblance with our form, especially with regard to the shape of the whorls and shape and direction of the old mouth-edges, really belongs to the present species.

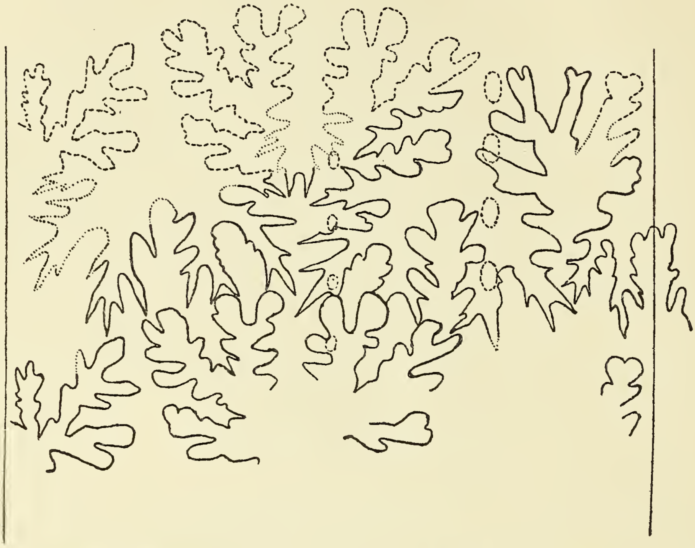
Genus HAMITES Parkinson.

Hamites amapondensis n.sp. Pl. III, figs. 5, 6, text-fig. 9.

There are two fragments of a characteristic Hamites, which no doubt belong to the same species. Both fragments are straight. The smallest, but more completely preserved specimen, is taken as the type.

Section elliptical. Shell ornamented with strong, thick ribs, which are separated by interspaces of not more than twice the breadth of the ribs. In the large specimen the ribs and interspaces have practically the same breadth. There are also four rows of tubercles parallel to the axis of the shell. Two of these are situated near the outer margin; the two others, one on each flank, are situated nearer to the middle of the flank than to the inner row of tubercles. Every rib bears a tubercle in every row. Between the two inner rows of tubercles the direction of the ribs is at right angles to the axis of the shell. On the flanks they pass from the inner row of tubercles slightly backwards till past the middle of the flanks; this portion is practically straight; further inwards they bend more backwards and this portion is therefore slightly convex forwards. In passing over the inner margin they are slightly concave forwards. In the type the tubercles of all rows are elongated longitudinally, while those of the inner rows are higher than those of the outer rows. In the paratype this longitudinal elongation has made place for a slight elongation of the bases of the tubercles in the direction of the ribs. Further all the tubercles of this specimen are connected by a narrow, sharp, longitudinal groove, which is clearly visible in the inner row of tubercles and only faintly in the outer row.

The lobe-line has been partially developed with acid on one side of the type. The saddles and lobes are all more or less of the same length; the first lateral saddle is, however, somewhat longer than the others. The external lobe is narrow and divided at its base by a siphonal saddle of nearly half the length of the lobe. This siphonal saddle is broader at its base than at its top. There is a secondary lobe, commencing opposite the top of the siphonal saddle and penetrating into the external saddle; it runs till near the external end of the first lateral lobe, and is about as narrow as but shorter than the posterior end of the external lobe. The first lateral lobe is beautifully bifid and very broad. It is just as long or perhaps slightly longer than the external lobe and appreciably longer than the external portion of the second lateral lobe. The difference in length between the first lateral lobe and the external portion of the second lateral lobe is about the distance between two ribs. The second lateral lobe is also bifid. The external saddle, which is unsymmetrically bifid, is much narrower than the beautifully bifid first lateral saddle, and practically just as broad as the antisiphonal saddle.



Text-fig. 9. *Hamites amapondensis.* Lobe-lines of type from dorsal to ventral line. ×3·8. The anterior portions of the saddles of a previous lobe-line have been added to the following one, where these portions are missing (dash-line). Unknown portions have been indicated by a dotted line. The "unknown" portion of the second lateral lobe has been drawn from a posterior view of a septum.

Measurements:

	Type	Paratype
Long diameter of section	20 mm.	About 40 mm. Actual transverse breadth of piece 35 mm.
Short diameter of section	16·3 mm.	

This species shows great resemblance with *Hamites quadrinodosus* Jimbo (**11**, p. 39, Pl. VII, figs. 3, 4). In fact, the resemblance is so great, that I at first felt inclined to regard our specimens as identical with the Japanese species. It appeared, however, that our specimens are slightly more oval, that the ribs might be somewhat closer together and that there might be a difference in the shape of the tubercles and the course of the ribs. Jimbo's description is not clear on these points. However, he gives a complete figure of one side of the lobe-line. It was therefore decided to develop at least a portion of the lobe-line of our specimen. It will be seen if the above description be compared with Jimbo's figure, that the two species have a lobe-line built after the same plan, but differing greatly in detail. The posterior end of the external lobe for example has an enormous lateral development in *H. quadrinodosus,* which differs greatly from that in *H. amapondensis*. The siphonal saddle has consequently a quite different shape. The external saddle of the lobe-line of *H. amapondensis* is quite different to that in *H. quadrinodosus*. The relation of the breadths of the external saddle and the first lateral saddle in *H. quadrinodosus* is quite different to that in *H. amapondensis*. The median secondary saddle in the first lateral lobe is narrow in *H. amapondensis* and broad in *H. quadrinodosus*.

The differences in the lobe-line, in connection with the difference in shape and with the probable differences in ornamentation, are apparently sufficient to regard the Pondoland specimens as belonging to a new species.

Genus HETEROCERAS d'Orbigny.

Heteroceras amapondense n.sp. Pl. IV, figs. 1, 2.

Shell spirally and dextrally wound; spiral vector long. Whorls in contact with each other. Last whorl bent backwards over the others in the direction of the apex of the shell. It is in contact with the penultimate whorl, but not with the whorl preceding this. Section of whorl somewhat elliptical, the long axis of the ellipse practically vertical on the spiral vector. In the young specimen present the section of the whorl is practically circular. The increase in size of the whorls is slow.

Whorls ornamented with numerous smooth, simple ribs, which are placed slightly obliquely. These ribs are broad at the base and very high on the external side of the shell; on the internal side they are fine, low and thread-like. The transition takes place on the upper surface of the whorl and is very rapid. On passing from the upper surface inwards the ribs also bend forwards. This, however, is only visible on the first whorl; in the second whorl this portion is covered by the first. In a very small specimen this forward bend is present, although much less pronounced than in the type, on its early end; on its later end the bend has nearly disappeared. In another, larger specimen this bend is also less conspicuous than in the type. On the first whorl present all ribs are of uniform size, but on the second, that is the last whorl before the irregular end and also on this end, one of the ribs, at irregular intervals, is very much larger than the others. The intervals present between the large ribs of the last whorl contain 7, 9 and 6 small ribs respectively, while the five intervals on the irregular end contain 3, 4, 3, 2 and 3 ribs respectively, and therefore the large ribs are closer together towards the end. The edge of the ribs is not sharp but broadly rounded in the large ribs and flattened in the small ones; the edges of this rounded or flattened surface stand out over the sides of the rib. The greatest height above the general surface of the shell of one of the large ribs, which is complete, is nearly 3 mm. For the greater part only the cast of the specimen is present and the ribs of the cast are much lower than those of the shell.

The lobe-line is not visible and it was not thought advisable to develop it on this specimen. However, a fragment, which is indistinguishable from the large specimen, shows portions of its lobe-line; these portions agree essentially with the lobe-line given by Woods (**17**, Pl. XLII, fig. 5 *c*) of *Heteroceras* sp.

I did not find any difference between this species and the two *Heteroceras* sp. and the *Hamites* (*Anisoceras*) sp. described by Woods (**17**, p. 339, Pl. XLII, figs. 4, 5, and p. 340, Pl. XLIV, fig. 3). From our specimen it is apparent, that the presence of stronger ribs here and there is a question of age, and because of their presence on one whorl and absence from another in the same specimen, this character cannot be used to separate fragments specifically.

I am not aware of any species with which the present can be confounded. Three specimens have been found.

Genus BACULITES Lamarck.

Baculites sulcatus Baily. Pl. III, figs. 7, 8.
Baculites sulcatus Baily. **3**, p. 457, Pl. XI, fig. 5 *c*.
Baculites sulcatus Woods. **17**, p. 341, Pl. XLIV, fig. 4.

Shell straight, tapering slowly. Transverse section generally oval, slightly narrower on the siphonal than on the antisiphonal side. Mostly there is a fairly great difference in the lengths of the axes of this oval, sometimes, however, this difference is less, and in one case the section is nearly circular. In another case the antisiphonal side is somewhat flattened. No longitudinal grooves have been noticed on our specimen.

The shell is ornamented with strong, rounded ribs. Starting on the siphonal side, they run obliquely backwards on the flanks. Some die out on reaching the middle of the flanks, while others continue to bend forwards on the edge between the flanks and the antisiphonal side. Here they form a transversely elongated tubercle. On the antisiphonal side they are convex forwards and very weak. The ribs are thicker on the siphonal side than on the flanks. The shell is covered by fine growth-ridges and grooves, which are fairly well visible in young stages, but which are far less conspicuous in large specimens. The ribs are stronger in young specimens than in old ones. In the largest specimen present they scarcely differ from the growth-lines, and the flanks of this specimen are nearly smooth, except for the tubercles. The relative distance of ribs and tubercles varies. In small specimens they are close together; at a long diameter of 5 mm. they are about 3·5 mm. apart. With advancing age they come further and further apart; in our largest specimen, with a long diameter of 14 mm. and 17 mm. over two consecutive tubercles, the distance of these two is 28 mm. The shape of the tubercles also varies. Sometimes, and mostly in younger specimens, they are crescentic, while in older specimens they are more knob-like, although still transversely elongated.

The lobe-line has not been seen.

There are twenty-two fragments which are regarded as belonging here. Although both Baily and Woods make no mention of the tubercles, I think there can be no doubt, that these specimens belong to Baily's type. They differ from *Baculites capensis* Woods (*l.c.*, p. 342, Pl. XLIV, figs. 6, 7) in the transverse elongation of the tubercles. There is a slight resemblance to the ornamentation of *Baculites anceps* Lamarck, figured by d'Orbigny (**1**, Pl. CXXXIX, figs. 1—7), but it seems that *Baculites incurvatus* Duj. (*l.c.*, Pl. CXXXIX, figs. 8, 10, and Schlüter, **6**, Pl. XXXIX, figs. 6, 7) stands very much nearer. The resemblance is also striking with the figures of this species given by Holzapfel (**8**, p. 64, Pl. IV, figs. 5, 6). The great difference seems to be the absence of the longitudinal grooves, which are present on most specimens of *B. incurvatus*, and perhaps the tubercles are smaller and rounder in our specimens. However, SCHLÜTER's specimens do not show longitudinal grooves.

Baculites Bailyi Woods. Pl. III, figs. 9, 10.
Baculites Bailyi Woods. **17**, p. 341, Pl. XLIV, fig. 5.

There are six fragments in the collection, which have been placed here. There is, however, still an element of doubt. Our specimens are practically smooth. Some of them show very faint ribs of the same shape as those of Woods' type figured by Baily (**3**, Pl. XI, fig. 5 *a*). The transverse section of our specimens varies from stretched oval to nearly circular. One specimen shows a fine carina. These shells greatly resemble *Baculites teres* Forbes as figured by Stoliczka (**4**, Pl. XC, fig. 12), in fact it seems to me practically impossible to distinguish between the two if one excepts the sulci of *B. teres*.

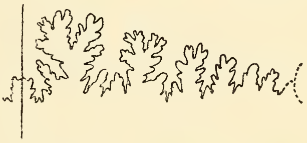
Genus DESMOCERAS Zittel.

Desmoceras simplex n.sp. Pl. III, figs. 11—16, text-fig. 10.

Shell thin, discoidal, umbilicated. Whorls higher than broad. Sides of whorl flat. Greatest thickness of whorl on the external portion of the flanks. In younger whorls the flanks are practically parallel. External surface broad, convex and smooth except for growth-lines and mouth-edges. The last portion of the last whorl of the large specimen is more strongly convex than its first portion and than the last whorl of the type. There is no line of demarcation between the flanks and the external surface. The umbilicus is extremely narrow. The flank passes abruptly into the umbilical surface, which is of moderate height and vertical to the plane of symmetry. The innermost portion of the umbilical surface slopes away from the centre and towards the plane of symmetry, and therefore the radius of the umbilical suture is longer than that of the middle of the umbilical surface. The involution is such, that only an extremely narrow strip of the preceding whorl remains uncovered.

The surface of the shell is smooth, except for some growth-lines, especially in the vicinity of the old mouth-edges. Old mouth-edges are visible as very shallow grooves on the shell and on the cast. These grooves are well visible on the external surface and on the external portion of the flanks, where they are bordered behind by a low rib. They disappear, however, towards the middle of the flanks. On the cast they are visible till near the umbilical edge. On the flanks they are straight or very slightly convex backwards and directed somewhat forwards. On the end of the last whorl of the large specimen they are very slightly convex forwards on the middle of the flanks. They run more forwards on the external surface, where they surround a tongue-shaped anterior process of the mouth-edge.

The lobe-line is typical for *Desmoceras*. All the saddles are bifid and all the lobes, except the external one, are trifid. The external lobe and the first lateral lobe are of equal depth. Six saddles are visible up to the edge of the umbilicus in the type; in the paratype there are seven saddles on this portion; these are arranged in a straight line and diminish gradually in height from the external saddle inwards.



Text-fig. 10. *Desmoceras simplex*. Lobe-line of type up to the umbilical edge on a radius of 9 mm. ×3.

Measurements:

	Type		Paratype		Paratype	
Diameter	25·7 mm.	(1·00)	26·6 mm.	(1·00)	44 mm.	(1·00)
Height of last whorl ...	14·3 ,,	(0·56)	14·5 ,,	(0·55)	24·6 ,,	(0·56)
Thickness of last whorl ...	10·5 ,,	(0·41)	12 ,,	(0·45)	17 ,,	(0·39)
Height of penult. whorl ...	7·5 ,,	(0·29)	7·6 ,,	(0·29)	12 ,,	(0·27)
Thickness of penult. whorl	6·4 ,,	(0·25)	7·2 ,,	(0·27)	9·2 ,,	(0·21)
Diameter of umbilicus ...	2 ,,	(0·08)	2·2 ,,	(0·08)	3·4 ,,	(0·08)

It is quite apparent that the systematic position of *Desmoceras simplex* is in the close vicinity of *D. diphylloides* Forbes sp. and *D. phyllimorphum* Kossmat. It differs from the last through its flat flanks. Further the old mouth-edges of *D. phyllimorphum* are convex forwards on the middle of the flanks; in *D. simplex* they are at the most only very slightly convex forwards on the middle of the flanks. In *D. phyllimorphum* the external portion of the mouth-edge forms a broad tongue-shaped anterior process; in *D. simplex* this process is narrow. The external lobe of the lobe-line of *D. phyllimorphum* is much broader than that of our form. Kossmat compares his species with *D. Larteti* Seunes (**12**, p. 175), a species placed by de Grossouvre in his genus *Schlüteria* (**10**, p. 218, Pl. XXXIV, figs. 2, 3). The differences between *D. Larteti* and *D. simplex* are so striking that it is not necessary to enumerate them here; however, the old mouth-edges form a similar anterior process on the external surface; in *D. simplex* it is perhaps slightly more pointed. A comparison with *D. diphylloides* Forbes sp. is more difficult. I could not lay my hands on Forbes' original description. Stoliczka calls *D. diphylloides* compressed (**4**, p. 119), and Kossmat, who has studied the type, describes its flanks as flattened (**12**, p. 174). Pervinquière, in describing ammonites from Tunis, refers some to Forbes' species as *Puzosia* (*Latidorsella*) *diphylloides* FORBES, and states of an adult specimen, that its flanks are nearly flat (**18**, p. 141). Even if the Odium specimens figured by Stoliczka are left out of discussion, we must come to the conclusion that the flanks of *D. diphylloides* are slightly convex, judged from the Pondicherry specimen figured in fig. 8 of Pl. LIX of **4**. Fig. 9 of Pl. XIX in Kossmat (**12**) also shows convex flanks. The figures of Pervinquière's specimens show clearly, that their flanks are, in accordance with the text, nearly flat. I therefore conclude, that the flanks of *D. diphylloides* are slightly convex; in *D. simplex* the flanks are quite flat. Stoliczka's figure mentioned above does not show old mouth-edges. These are, however, well visible in Kossmat's figures. They are in the first place convex forwards on the middle of the flanks, and secondly they form a broad tongue-shaped anterior process on the external surface. In our form they are at the most only very slightly convex forwards on the flanks, while the tongue-shaped process is not broad but very narrow. In Pervinquière's specimens the tongue-shaped process is also very narrow. The figures of some of them show quite clearly, that the mouth-edges are slightly convex forwards on the middle of the flanks. Pervinquière unites with *Puzosia* (*Latidorsella*) *diphylloides* Forbes sp. the specimens from Vancouver, described by Whiteaves as *Ammonites Selwynianus*. *Desmoceras Selwynianus* Whiteaves sp. (**7**, Pt II, p. 104, Pl. XIII, fig. 1) differs from *D. simplex* in the following points: the old mouth-edges are more convex forwards on the middle of the flanks and the tongue-shaped process on the external surface is longer. The flanks of the whorl are decidedly convex as shown in the figures and according to the text, for although the sides are said to be somewhat compressed, the whorls are also stated to be thickest near the middle of the sides. The *Desmoceras* described by de Grossouvre as *D. pyrenaicum* (**10**, Pl. XXXVII, fig. 9), but which according to Pervinquière does not belong to that type (**18**, p. 142), shows great resemblance to *D. simplex*. The figure seems to show, that the old mouth-edges are fairly straight on the flanks, but form a very broad, tongue-shaped anterior process on the external surface. The sides seem to be flattened and convergent towards the centre.

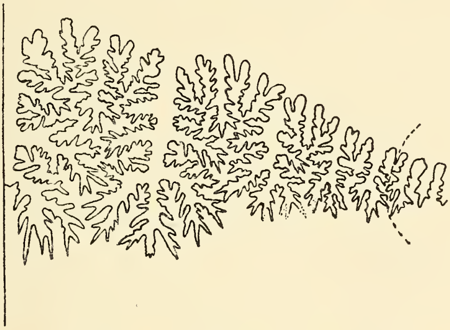
Four specimens of this species have been found, three of which have been used for the description.

Desmoceras crassum n.sp. Pl. IV, figs. 3, 4, text-fig. 11.

Shell thin, discoidal, umbilicated. Whorls higher than broad. Greatest thickness of the whorl in the middle of the flanks. Sides of whorl slightly convex. External surface very broad and strongly convex. External surface and flanks round off imperceptibly into each other. The umbilicus is very narrow. The flank rounds off broadly into the umbilical surface, which is high and slightly convex and somewhat sloping towards the centre. The innermost portion of the umbilical surface slopes away from the centre and towards the plane of symmetry, and therefore the radius of the umbilical suture is longer than that of the umbilical surface immediately adjoining the suture. The involution is such, that only an extremely narrow strip of the preceding whorl remains uncovered.

The surface of the shell of both specimens is badly preserved; as far as can be ascertained the shell is smooth and covered by fine growth-lines. Old mouth-edges have not been observed.

The lobe-line is built after the type of *Desmoceres latidorsatum* Mich. sp. and *D. diphylloides* Forbes sp. It is greatly incised. The saddles are not only bifid, but each portion is subdivided again and again. The lobes, except the external one, are irregularly trifid. The external lobe is just as long as the first lateral one. The siphonal saddle is remarkably small. Nine saddles are visible up to the smallest diameter of the umbilical surface. These are arranged in a straight line and diminish gradually in height towards the umbilicus.



Text-fig. 11. *Desmoceras crassum*. Lobe-line of type up to near the umbilical suture on a radius of 16 mm. ×3·5.

Measurements:

	Type	Paratype
Diameter	34·6 mm. (1·00)	30·2 mm. (1·00)
Height of last whorl	20·1 ,, (0·58)	17·3 ,, (0·57)
Thickness of last whorl ...	16·3 ,, (0·47)	13·5 ,, (0·45)
Height of penultimate whorl ...	8 ,, (0·23)	
Thickness of penultimate whorl	7 ,, (0·20)	
Diameter of umbilicus... ...	2·8 ,, (0·08)	

Desmoceras crassum greatly resembles *D. pyrenaicum* de Gross. (**10**, Pl. XXV, fig. 2, now Pl. XXXVII, fig. 9). The relations of height and breadth of the last whorl are, however, different. The umbilicus of our form is much smaller and its lobe-line is far more complicated.

I am not aware of any other form with which the present species could be confounded. Especially in its dimensions it differs from similar forms.

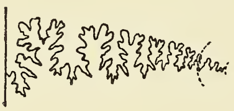
Only two fragmentary specimens have been found.

Desmoceras compactum n.sp. Pl. IV, figs. 5—7, text-fig. 12.

Shell thin, discoidal, umbilicated. Whorls higher than broad. Greatest thickness of the whorl at the junction of external surface and flanks. Sides of whorl flattened, converging slightly towards the umbilicus. External surface broad and convex and provided with a narrow, low, cork-like keel. The convexity of the shell is greatest between the external surface and the flanks, but there is no sharp line of demarcation between the two surfaces. The umbilicus is extremely narrow. The flank slopes gradually inwards towards the umbilical surface, which is very low and strongly convex. The inner portion of the umbilical surface slopes away from the centre and towards the plane of symmetry, and therefore the radius of the umbilical suture is longer than that of the middle of the umbilical surface. The involution is such, that only an extremely narrow strip of the preceding whorl remains uncovered.

The surface of the shell is smooth, except perhaps for growth-lines, especially in the vicinity of old mouth-edges. Old mouth-edges are visible as very shallow grooves bordered by fine ridges and growth-lines. There are three of them close together on the last whorl. Their general direction on the flanks is more or less radial. They are slightly concave forwards on the inner portion and slightly convex forwards on the middle of the flanks, while they are again concave forwards on the external portion of the flanks and on the outer surface. They run very far forwards on the outer surface, making an extremely sharp angle with the median line.

The lobe-line is typically that of *Desmoceras* as represented by *D. sugata* Forbes sp. All the saddles are bifid and all the lobes except the external one are trifid. The external lobe is slightly longer than the first lateral lobe. Ten saddles are visible up to the smallest diameter of the umbilical surface; these are arranged in a straight line and diminish gradually in height towards the umbilicus.



Text-fig. 12. *Desmoceras compactum.* Lobe-line of type up to near the umbilical suture on a radius of 7 mm. × 3. The long dotted line indicates the approximate border between the flank and the umbilical surface; the short one indicates the shortest radius of the latter surface.

Measurements:

Diameter	18·2 mm.	(1·00)
Height of last whorl	10 ,,	(0·55)
Thickness of last whorl ...	8·3 ,,	(0·46)
Height of penultimate whorl ...	4·8 ,,	(0·26)
Thickness of penultimate whorl	4·9 ,,	(0·27)
Diameter of umbilicus... ...	1·7 ,,	(0·09)

The present form belongs to the group of *Desmoceras sugata* Forbes sp. Its whorls, however, differ from those of the Indian form in section, firstly because the keel is not so high and secondly because the greatest thickness of the whorl of the African species lies at the external edge of the flanks. The umbilicus is also relatively narrower. The old mouth-edges are also differently shaped. In *D. compactum* they are clearly visible near the umbilicus, but this is perhaps not true of all of them. They are, however, slightly convex forwards on the middle of the flanks and this is not so in *D. sugata.* Further they form a very sharp point on the external surface, a point which is much sharper than in *D. sugata.* There are slight differences in the lobe-line. The external lobe is longer than the first lateral one, not shorter, the saddles do not diminish so rapidly in size towards the umbilicus and there may be one or two saddles more in *D. compactum.* Our form differs from *D. sugata* figured by Yokoyama (**9**, Pl. XX, fig. 11) in the section of the whorl and in the relatively narrower umbilicus. *Desmoceras obscurus* Schlüter sp. (**6**, p. 70, Pl. XXII, figs. 9, 10) has a different whorl section and a much wider umbilicus.

Only one specimen of this species has been found.

Holcodiscus africanus v. Hoepen.
1920. *Holcodiscus africanus* v. Hoepen, **20**, p. 146, Pl. XXVI, figs. 3—5.

Three specimens have been found, which are referable to the above species. The largest of the three belongs here without any doubt. The specimen is fragmentary and most of its shell has exfoliated. A small portion of the shell of the last whorl has, however, been preserved and this small portion is remarkable. Its ribs are very strong, high, narrow and wire-like. In two places this shell-portion passes over the external surface on to the other flank and it appears that the ribs in these two places pass with undiminished strength over the external surface. In between, where the shell is broken away, the cast shows a siphuncular groove, but not a trace of ribs. In front of the preserved shell-portion the cast shows the siphuncular groove and ribs on the flanks, which disappear on the external surface. Further forwards the siphuncular groove disappears under thin layers of shell and here the strong ribs of the flanks pass over the external surface, but very much flattened. In a young stage of this shell, which has not suffered from weathering and of which a portion of the external surface is visible, the ribs do not pass over this surface. The ribs of the penultimate whorl have not suffered from weathering and are strong on the flanks, while some have disappeared and the remainder are only faintly visible on the siphuncular region. The shell of the type is sound. It is quite clear that the comparative smoothness of its external surface is not due to exfoliation. However, at the beginning of the last whorl, the shell shows a remarkable irregularity. The siphuncular line has here been displaced on to one of the flanks, where the ribs are cut off abruptly. The ribs of the other flank pass over the external surface, and then bend strongly backwards until they meet the displaced siphuncular line. Slightly further backwards the ribs on the flank which bears the siphuncular line have irregular directions, some even being bent backwards. Possibly this irregularity must be ascribed to some accidental cause, perhaps a wound. Perhaps also the character of a comparatively smooth siphuncular region must be allowed a certain variability. In the two other specimens the ribs become very faint on the external surface. A character which appears to be variable is the number of ribs on a limited surface, *i.e.* the relative density of the ribbing. One of the new specimens has ten ribs on 1 cm. peripheral length at a longest diameter of 27 mm. In the type there are eight ribs on the same length at the same diameter. This difference gives the ribbing of the new specimen a decidedly finer appearance. Again, a small specimen has ten ribs on 1 cm. peripheral length at a diameter of about 16 mm. and therefore its ribbing is relatively coarser.

Holcodiscus africanus ? v. Hoepen.

There is one specimen of a *Holcodiscus* which resembles very much *Holcodiscus africanus*, but which differs from this species in several respects. Its dimensions are as follows:

Diameter	25·9 mm.	(1·00)
Height of last whorl	10·5 ,,	(0·41)
Thickness of last whorl ...	10·1 ,,	(0·39)
Height of penultimate whorl ...	5·4 ,,	(0·21)
Thickness of penultimate whorl	6 ,,	(0·23)
Diameter of umbilicus... ...	8·2 ,,	(0·31)

If compared with the type of *H. africanus* it will be seen, that the relative thickness of the last whorl of this specimen is much greater than that of the type. However, in the type the height and thickness of the whorls change with the diameter and it is difficult to judge with a changing character. Still the last whorl of the type has only a thickness of 9·5 mm. where its height is 10·5 mm. The present specimen is, therefore, relatively thicker than the type.

There are other differences. The ribs are much lower and closer together and, which is especially remarkable, they disappear before reaching the tubercles on the umbilical edge. It is just possible, that the last fact is due to bad preservation, although the shell seems to be fairly well preserved. There is also a slight difference in the lobe-line. The first auxiliary lobe is much deeper and the first lateral saddle, the first auxiliary lobe and the first auxiliary saddle are together much broader than in the type. However, these differences are of such a nature, that one does not feel convinced, that the present specimen belongs to a new species; it is also difficult to unite it with *H. africanus*.

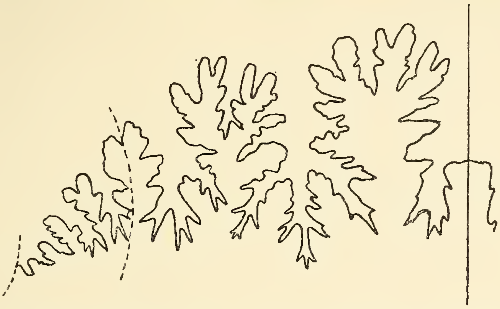
Genus PACHYDISCUS Zittel.

Pachydiscus antecursor n.sp. Pl. V, figs. 1, 2, text-fig. 13.

Shell discoidal. Whorls increasing slowly in size. Thickness of whorls equal to or slightly less than the height. Greatest thickness near the middle of the flanks. Sides of whorl and external surface convex; there is no demarcation between the external surface and the flanks. The flank curves gently into the fairly steep umbilical surface. Height of the umbilical surface moderate. The involution is small, being only slightly more than one-third and less than two-fifths of the preceding whorl.

The ornamentation consists of broad, low ribs of different length. The longer ribs start near the umbilical surface. Some of them are here slightly narrower and higher than elsewhere. They pass over the external surface, which is slightly weathered, so that it cannot be made out with certainty, whether their strength diminishes on this surface or not. There are indications that these ribs are slightly weaker on the external surface. The long ribs are irregularly placed. Sometimes a long rib is immediately followed by another long rib. Sometimes there is one short rib between two long ones, and in other instances there are two or three short ribs between two long ones. The short ribs start at irregular distances from the umbilical surface, but as far as can be made out, they all start between the umbilical surface and the middle of the flanks. Their origin is very obscure, for they rise very slowly out of the general surface of the shell. Their external end is sometimes as high as that of the long ribs, but more often their height is less. The interspaces between the ribs are broader than these. The umbilical surface is covered with growth-lines, which run from the suture backwards and pass on to the flanks in a direction parallel to the ribs. They cannot be traced on the flanks for the delicate surface has not been retained there. In passing on to the flanks they are concave forwards. The general direction of the ribs is radial. Their internal end is slightly convex forwards. External to the middle of the flank the ribs are slightly concave forwards. In passing over the external surface they are again convex forwards. At least three-quarters of the last whorl is body-chamber. Old mouth-edges are difficult to identify. The ribbing of the older whorls is relatively somewhat stronger than that of the end of the last whorl.

The lobe-line is typical for *Pachydiscus*. Through the nature of its preservation it was difficult to develop the lobe-line and much of its fineness has been eaten away by the acid. The external lobe is only very slightly shorter than the first lateral one. The external saddle, the two lateral saddles and the first auxiliary saddle are symmetrically divided by a secondary lobe. The saddles diminish gradually in height inwards. The first lateral lobe is trifid. The second lateral lobe and the first auxiliary lobe do not pass so far backwards as the first lateral lobe. The umbilical portion of the lobe-line runs obliquely backwards and consists of four auxiliary saddles and five lobes.



Text-fig. 13. *Pachydiscus antecursor.* Lobe-line of type up to the umbilical suture on a radius of 25 mm. ×2·5.

Measurements:

Diameter	78 mm.; was probably 79	mm.	(1·00)
Height of last whorl	probably 27·4	,,	(0·35)
Thickness of last whorl ...	27·4	,,	(0·35)
Height of penultimate whorl ...	17	,,	(0·22)
Thickness of penultimate whorl	15·7	,,	(0·20)
Diameter of umbilicus... ...	28·3	,,	(0·36)

Pachydiscus antecursor differs from *P. Vaju* Stol. sp. in having a larger umbilicus and a different sculpturing. *P. anapadensis* Kossm. is a relatively thicker shell. There is great resemblance with *P. Jimboi* Kossm. In *P. Jimboi,* however, the thickness of the older whorls is apparently slightly greater than the height, whereas in *P. antecursor* this is the reverse. In *P. Jimboi* the ribs form an angle on the external surface, while in our form they are only slightly convex forwards. *P. Yokoyamai* Jimbo differs from our form in having broader whorls. In *P. Egertonianus* Forbes sp. the section of the whorls is higher than broad. There are also umbilical tubercles; in our form there are no tubercles, not even in the earliest stages; ribs are present in our form on whorls of about 1 cm. diameter; the surface of the whorls with a lesser diameter is damaged. In certain stages of *P. Egertonianus* the ribs are weaker on the flanks than elsewhere; nothing of this kind is noticed in *P. antecursor.* The lobe-line of *P. Tweenianus* Stol. sp. resembles that of our form very much; however, the shape of the ribs is different in the African form and especially the shape of their convexity towards the front on the external surface. The whorls of *P. Levyi* de Gross. are broader than high and their ribs have a different shape from those of our form.

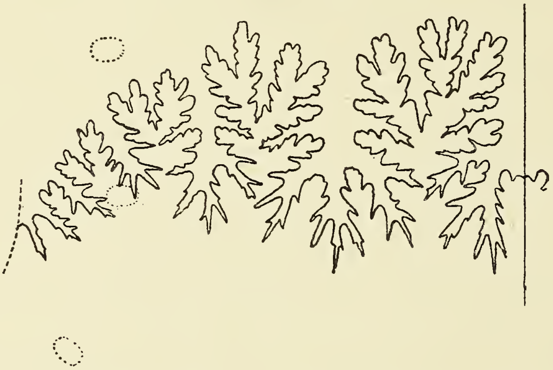
Of this species only one specimen has been found.

Pachydiscus simplex n.sp. Pl. V, figs. 3, 4, text-fig. 14.

Shell discoidal. Whorls increasing slowly in size. Whorls slightly thicker than high. Greatest thickness near the umbilical edge. Sides of whorl and external surface convex; there is no demarcation between the external surface and the flanks. The sides curve gently into the sloping umbilical surface. Height of the umbilical surface moderate. Involution slightly more than one-half of the preceding whorl.

The ornamentation consists chiefly of umbilical tubercles of which there are about twelve or thirteen on the last whorl. These tubercles are only present on the last whorl and a quarter, the earlier whorls being smooth. The tubercles are transversely elongated; highest near the umbilical edge, broadening and ultimately disappearing towards the middle of the flanks. The shell surface is very much worn and large patches have peeled off. As far as can be made out the shell was smooth, except for the tubercles, on flanks and external surface. The umbilical surface shows very fine growth-lines or ribs, closely but irregularly placed and concave forwards. It is very probable, that these fine lines continued on the flanks, but this is not shown in the specimen. A smaller specimen, with tubercles on three-quarters of the last whorl only, shows that the shell is covered with very fine growth-lines, which are concave forwards on the umbilical surface, convex forwards on the inner half and concave forwards on the outer half of the flanks, and very slightly convex forwards on the external surface.

The lobe-line is a typical *Pachydiscus* one. The external lobe is just as long as the first lateral one. The external saddle, the two lateral saddles and the first auxiliary saddle are deeply divided by a secondary lobe. The saddles diminish gradually in height inwards. Both lateral lobes are trifid. The second lateral lobe is shorter than the first. The first auxiliary lobe is also very long. The umbilical portion of the lobe-line runs obliquely backwards and consists of four auxiliary saddles and lobes.



Text-fig. 14. *Pachydiscus simplex*. Lobe-line of type up to the umbilical suture on a radius of 21 mm. ×3·3.

Measurements:

	Type		Paratype		Paratype	
Diameter	40 mm.	(1·00)	17·2 mm.	(1·00)	28 mm.	(1·00)
Height of last whorl ...	15 ,,	(0·37)	6·9 ,,	(0·38)	11 ,,	(0·39)
Thickness of last whorl ...	15·7 ,,	(0·39)	7·5 ,,	(0·44)	12 ,,	(0·43)
Height of penult. whorl ...	8 ,,	(0·20)	4 ,,	(0·23)	6·4 ,,	(0·23)
Thickness of penult. whorl	8 ,,	(0·20)	4·2 ,,	(0·24)	6·5 ,,	(0·23)
Diameter of umbilicus ...	13·2 ,,	(0·33)	5·4 ,,	(0·31)	8·6 ,,	(0·31)

The type and the smallest specimen are quite normal and have not suffered in the least from pressure; both are wholly septate. The middle specimen has become slightly irregular from pressure.

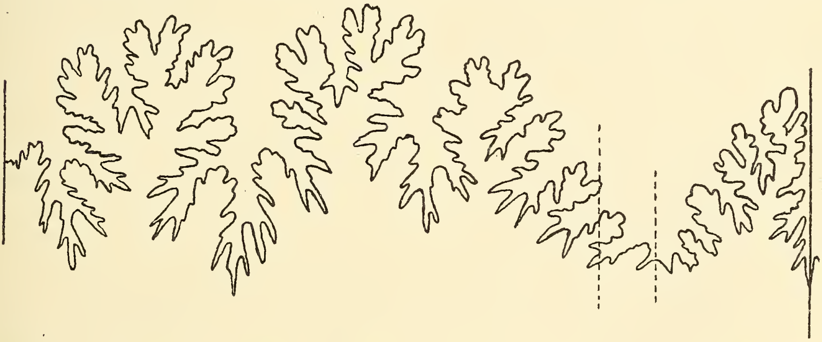
Pachydiscus simplex is very closely related to *Pachydiscus Cricki* Kossmat, especially because the ornamentation appears to be the same. There are, however, typical differences. *P. Cricki* has relatively much thicker whorls and a relatively smaller umbilicus. The lobe-line shows a typical difference in its umbilical portion, which runs obliquely backwards in *P. simplex* and is nearly vertical and shorter in *P. Cricki*. *Pachydiscus Ganesa* Forbes sp. shows totally different relations.

Three specimens of this species have been found.

Genus HAUERICERAS de Grossouvre.

Hauericeras Gardeni Baily sp. Text-fig. 15.
1855. *Ammonites Gardeni* Baily, **3**, p. 456, Pl. XI, fig. 3.
1864. *Ammonites Gardeni* Stoliczka, **4**, p. 61, Pl. XXXIII, fig. 4.
1872. *Ammonites Gardeni* Schlüter, **6**, p. 55.
1879. *Ammonites Gardeni* Whiteaves, **7**, p. 102.
1890. *Desmoceras Gardeni* Yokoyama, **9**, p. 184, Pl. XX, fig. 10.
1894. *Hauericeras Gardeni* de Grossouvre, **10**, pp. 219, 220.
1898. *Hauericeras Gardeni* Kossmat, **12**, p. 188, Pl. XXIV, figs. 7, 8, 10.
1903. *Hauericeras Gardeni* Whiteaves, **7**, p. 352. 122
1904. *Hauericeras Gardeni* Yabe, **15**, Pt II, p. 32.
1906. *Hauericeras Gardeni* Woods, **17**, p. 332.

There are a dozen fairly well preserved specimens of this species in the collection and a good many fragmentary ones. I have nothing to add to the existing descriptions, except a few remarks especially on the lobe-line. In Baily's figure the external lobe is just as long as the first lateral lobe. It is the same in Kossmat's and Yokoyama's figures of a specimen from Yesso. In the description of this specimen Yokoyama states: "Die Loben sind deutlich ungleich dreiteilig und ihr Mittelast greift nicht so tief hinein wie bei den indischen Exemplaren, in dieser Hinsicht mehr mit der Abbildung von Baily übereinstimmend." De Grossouvre states in his diagnosis of the genus *Hauericeras*: "Le premier lobe latéral est aussi long que le lobe ventral." In three of our specimens the lobe-line has been developed and in all three the second lateral lobe is conspicuously longer than the external lobe, exactly as in Stoliczka's figure. This condition is more like that of *Puzosia planulata*



Text-fig. 15. *Hauericeras Gardeni*. Lobe-line of plesiotype from ventral to dorsal line on a radius of about 43 mm. × 3. The longest dash-line indicates the umbilical edge, the shortest the umbilical suture.

Sow.; however, the resemblance between the type of lobe-line of this species and that of *Hauericeras Gardeni* becomes striking when a complete lobe-line of the last (Text-fig. 15) is compared.

In detail, however, there is a lot of difference. Except the differences mentioned by Kossmat (**12**, p. 188) I regard also the following as important. In *Puzosia planulata* Sow. the external saddle reaches further forwards than the first lateral one, while in *Hauericeras* this is the reverse. The internal saddles also reach further forwards. In *P. planulata* the external secondary saddle in the first lateral lobe reaches further forwards than the internal one; in *Hauericeras* this is the reverse.

Yokoyama remarks *l.c.*, that in the figures given by Stoliczka and Baily the umbilical surface is steep but not vertical to the plane of symmetry, whereas in all Japanese forms and in an Indian form examined by him, the umbilical surface is vertical to the plane of symmetry. In our collection both types are represented. In a large specimen the umbilical surface of an earlier whorl is practically vertical to the plane of symmetry, while that of its last whorl is inclined.

Measurements of our largest specimen:

Diameter	120	mm.	(1·00)
Height of last whorl	41	,,	(0·34)
Thickness of last whorl ...	21	,,	(0·17)
Height of penultimate whorl ...	23	,,	(0·19)
Thickness of penultimate whorl	11·5	,,	(0·10)
Diameter of umbilicus... ...	47·5	,,	(0·40)

It is remarkable that no specimens of *Hauericeras Rembda* Forbes sp. have been found. There are, however, two small specimens, which might belong here. In one of these the old mouth-edge is nearly straight except for a very slight anterior convexity on the middle of the flank; in the other the old mouth-edge consists of two radial pieces of which the ends, near the middle of the flank, are connected by a short, oblique cross-piece. Apparently there is a considerable irregularity in these mouth-edges.

Genus SCAPHITES Parkinson.

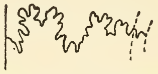
Scaphites Cunliffei Forbes sp. Pl. V, figs. 5—7, text-fig. 16.
1845. ***Ammonites Cunliffei*** Forbes, *Foss. Inv. South. India*, p. 109, Pl. VIII, fig. 2 *a—d*.
1845. ***Ammonites Pavana*** Forbes, *ibid.* p. 110, Pl. VII, fig. 5 *a—b*.
1865. ***Ammonites Cunliffei*** Stoliczka, **4**, p. 97, Pl. L, fig. 3.
1897. ***Scaphites Cunliffei*** and ***Scaphites Pavana*** Kossmat, **12**, p. 138.
1907. ***Scaphites Cunliffei*** Pervinquière, **18**, p. 124, Pl. IV, figs. 36—42, *A*, *B*, *C*.

There are two specimens in the collection, which so much resemble the variety *Pavana* of *Scaphites Cunliffei* Forbes sp. as described by Pervinquière, that I can only place them here.

The section of the whorl is quadrangular with rounded off angles, much higher than broad. The sides are flattened and the external surface is slightly convex. The shell of the best preserved specimen consists of nearly five whorls. The greater part of the last whorl is covered with fairly strong ribs, which are convex forwards near the middle of the flanks and on the external surface. Short ribs are intercalated here and there between the others; they are well visible on the external surface, but die out before reaching the middle of the flanks. The convex portion of the ribs near the middle of the flanks is somewhat more conspicuous than the rest. There are no tubercles. The preceding whorls are smooth.

The other specimen present consists of the complete involute portion together with the beginning of the evolute portion. Not a vestige of tubercles is seen on this specimen.

The lobe-line so strikingly resembles, even in detail, that of *Sc. Cunliffei* drawn by Pervinquière, that its reproduction here may be regarded as sufficient. The only difference between our specimens and those of Pervinquière seems to lie in a greater involution, which is one-third in the latter and more than one-half but less than two-thirds in the former. However, the species seems to be so variable, that this can scarcely be of any consequence.



Text-fig. 16. *Scaphites Cunliffei*. Lobe-line of plesiotype up to the umbilical suture on a radius of 6 mm. ×3·5.

Measurements:

	I.	II.
Diameter	13·2 mm. (1·00)	14·5 mm. (1·00)
Height of last whorl ...	5·8 „ (0·44)	7·3 „ (0·50)
Thickness of last whorl	4·6 „ (0·35)	5·5 „ (0·38)
Diameter of umbilicus	3·8 „ (0·29)	3·1 „ (0·21)

The measurements of II. are taken on a diameter exactly before the evolute portion begins.

Scaphites sp. Pl. V, figs. 8, 9.

Two other specimens in the collection, greatly resembling each other, have also been referred to *Scaphites*. The shells are completely coiled and if *Scaphites*, the uncoiled portion has broken off. The preserved portion is discoidal, umbilicated. Sides of last whorl convex, external surface slightly flattened, especially near the end. The beginning of the last whorl is much thicker than high; at the end of the last whorl of the large specimen the height and thickness are about equal; in the small specimen the end of the last whorl is broader than high. The shell is covered with very coarse transverse ribs, which start on the umbilical edge without forming a tubercle. Most of these long ribs curve slightly forwards on the middle of the flanks, where they are thicker than anywhere else and from whence they generally bifurcate. Sometimes they do not bifurcate, but then a short rib, beginning on the middle of the flanks and running outwards, is intercalated between two long ones. All these ribs cross the external surface. On the last portion of the last whorl of the large specimen the ribs are slightly thickened on passing from the flanks on to the external surface. It will be seen from the figure, that the large specimen is not a regular spiral. There is nothing to show that this irregularity is not normal. Its umbilicus is much larger on one side than on the other.

Measurements:

	Small specimen	Large specimen
Diameter	16·3 mm. (1·00)	20 mm.
Height of last whorl	7·3 „ (0·45)	11 „
Thickness of last whorl ...	9 „ (0·55)	9·6 „
Height of penultimate whorl ...	3 „ (0·18)	4 „
Thickness of penultimate whorl	4 „ (0·25)	5 „
Diameter of umbilicus... ...	4 „ (0·25)	4·5 „ —3 mm.

The ornamentation of these specimens shows great resemblance with that of *Scaphites*? *andurensis* Stoliczka sp. However, there is no conspicuous row of tubercles on each side of the external surface in our specimens, and the relations of height and thickness of the last whorl are also different. There is also some resemblance with *Sc. aequalis* Sow. Our shell, however, has a coarser ornamentation, is relatively broader and has a wider umbilicus. I cannot find any known species with which our specimens completely agree, but then, the portion which often shows the most striking characters is missing. It will, therefore, be better to leave definite decisions in abeyance till further material is available.

Scaphites sp.

The collection contains another, very badly weathered, specimen of a scaphites. The involute portion is missing, as well as the end of the evolute portion; the remainder is only present as cast. This evolute portion is high and narrow, its sides are practically flat and its external surface is very narrow and slightly convex transversely. The sides are covered with coarse ribs, which may have been slightly thicker on the middle of the flanks, where they probably bifurcated, and where, apparently, they were slightly bent forwards. A row of tubercles is present on the edge of the external surface. These tubercles are large on the middle of the uncoiled portion, while they completely disappear before reaching the mouth-edge and gradually become smaller towards the back; they do not seem to be present on the uncoiled portion. At the anterior end of the specimen the ribs are seen to cross the external surface, which is here more rounded than before.

Genus PELECODISCUS n.g.

"...the sutures. These have, however, so much broader and shorter saddles than any specimen of that species I have ever seen, that, if there is any specific distinction in such peculiarities, these forms can not be included in an existing species." Hyatt, in his description of *Sphenodiscus Stantoni* (**13**, p. 70).

This genus is proposed for shells similar to *Eulophoceras*. It differs from the latter especially in the lobe-line and here the principal difference lies in the third lateral saddle, which is very short in *Eulophoceras* and practically of the same length as the first two lateral saddles in *Pelecodiscus*; the fourth and further lateral saddles also reach far less forwards in *Eulophoceras* than in *Pelecodiscus*. In the new genus the two pairs of posterior secondary lobes of the external lobe are very conspicuous; a third more anterior pair is not present or only slightly developed. Four species are known to belong to this genus, three of which are being described hereafter and the fourth being *Lenticeras Jullieni* Pervinquière from Algeria (**19**, p. 69). The lobe-line of *Eulophoceras natalense* given by Hyatt and that of the same species given by Woods are reproduced on Pl. VI, figs. 2, 3 for comparison. The lobe-line of *Pelecodiscus Jullieni* Pervinquière sp. is also reproduced, Pl. VI, fig. 4.

Pelecodiscus umzambiensis n.sp Pl. V, fig. 10; Pl. VI, fig. 1.

Shell discoidal, with closed umbilicus. Whorls much higher than broad and increasing rapidly in size. The greatest thickness of the last whorl is situated at about one-quarter of the height of the whorl from the centre of the umbilicus, in the large shells; in the small specimen the greatest thickness is very close to the centre of the umbilicus. The lateral surface of the whorls is slightly convex. In the large specimens the convexity is somewhat greater near the umbilicus, where the shell is thickest. The umbilicus is filled with shell-growth, which is raised in the centre to a kind of process. Around this process lies a groove-like concavity. The sides of the shell are slightly concave on both sides of the keel. The keel is sharp, and where its edge is still protected by matrix it is even as sharp as a knife. A portion of the mouth-edge of the left side is preserved. This edge is slightly convex forwards at the umbilicus, concave forwards near the middle of the flank and again convex forwards at about one-third of the height from the periphery.

The ornamentation consists of folds, spiral lines and growth-lines. Although the spiral lines and growth-lines are plainly visible, the details of this ornamentation cannot be given with absolute certainty, for the shell has been reduced to such thinness by weathering, that portions of sutures are visible everywhere. As far as can be made out, the spiral lines form a broad zone, which is situated on the inner portion of the outer half of the flanks. These lines are extremely shallow grooves, which are separated by broad and very slightly convex interspaces. In the type specimen growth-lines are only visible on one side of the beginning of the last whorl, and that from the umbilicus till past the middle of the flanks. This portion of the growth-lines has the same shape as the preserved portion of the mouth-edge. Growth-lines are preserved on a portion of another specimen, from the umbilicus till near the keel, the inner portion having practically the same shape as the preserved part of the mouth-edge of the type. The forward convexity, which in the type lies at about one-third of the height from the periphery, is here situated very near to the middle of the flank. From the convexity outwards the growth-line is strongly concave forwards. It is still concave forwards where it dies out close to the keel. Apparently, therefore, the keel was drawn forwards into a point.

The flanks are covered by numerous more or less radial undulations. These undulations are practically invisible near the umbilicus, become more conspicuous on the middle of the flanks, and quite prominent on the outer half of the flanks. On the inner portion of the flanks they are directed outwards and forwards, and on the outer portion outwards and backwards, so that they form a rounded angle near the middle of the flanks. Sometimes a short undulation is intercalated between two long ones on the outer portion of the flanks. Such a short one may unite with the long one posterior to it before reaching the middle of the flank, and the point of conjunction may be more prominent than the rest of the undulation. All undulation disappears on reaching the keel.

The lobe-line is very interesting. The external lobe is broad and deep, and divided by a very broad and very short siphonal saddle. It sends a secondary lobe backwards and inwards alongside of the siphonal saddle and another secondary lobe backwards and inwards into the body of the first lateral saddle, about in the middle of its length. These two secondary lobes are very conspicuous in all our specimens of *Pelecodiscus*. The first lateral lobe, which is long and of moderate breadth, is nearly as long as the external lobe, the last reaching slightly further backwards. This is taken with regard to a straight line through the centre of the umbilicus and the top of the siphonal saddle. The second lateral lobe is very broad and long. It has the same length as the external lobe and it reaches just as far backwards. Along its outline are many secondary lobes and saddles, arranged apparently without system. The third lateral lobe is short and moderately broad. It is about half as long as the second lateral lobe and reaches about half as far backwards. In the type it is trifid, but in the two other specimens it is irregular. The fourth lateral lobe is shorter than the third, but practically of the same breadth; it reaches slightly further backwards. In the type it is trifid, but in another specimen bifid. The fifth lateral lobe is greatly covered by the umbilical growth; it is very near to the umbilical edge of the shell. All that can be made out is, that it is very much shorter than the fourth lateral lobe.

The three first lateral saddles are broad. The two first have a generally rounded anterior contour, while the third is rather broad and flattened anteriorly. The two first saddles are cut up by numerous secondary lobes; the third is bifid and both its arms are also bifid. The second reaches slightly further forwards than the first. The third reaches just as far forwards as the first. The fourth lateral saddle is broader and shorter than the third; it is deeply bifid and both its arms are also bifid. The fifth lateral saddle is narrower than the fourth; it is also bifid and its arms show a tendency to bifidity. In the larger paratype the fourth lateral saddle is much narrower than the third. A line touching the anterior tips of all the saddles, is slightly convex forwards throughout. Its inner third runs gradually more and more backwards.

Measurements:

Diameter	about 125 mm.	(1·00)
Height of last whorl ...	„ 77 „	(0·62)
Thickness of last whorl	26 „	(0·21)

Comparison with *Eulophoceras* must chiefly be based on the lobe-lines, for the state of preservation of Hyatt's type does not allow of much else. The lobe-line of *E. natalense* as figured by Hyatt (**14**, Pl. XI, fig. 2, and reproduced Pl. VI, fig. 2) differs considerably from that of the present specimen. The second lateral lobe does not reach so far backwards. The second lateral saddle reaches much further forwards and the fourth and further lateral saddles are differently arranged. The third lateral saddle is much shorter than the first. The consecutive sutures are also closer together than in any of our forms of *Pelecodiscus*. For better demonstration of these differences a reproduction is given of the sutures of *E. natalense* as drawn by Hyatt. There is no other described South African form, which is closely related to the present species. Its nearest relation, except two other new South African forms, is *Lenticeras Jullieni* Pervinquière, from Algeria (**19**, p. 69). It is quite clear that the present form and the North African one belong to the same genus; in fact, the resemblance is so great, that they can only be separated by detail. The principal difference lies in the fact, that *Pelecodiscus Jullieni* has fairly strong undulations near the umbilicus and is at least much smoother near the periphery, while in *P. umzambiensis* the area around the umbilicus is smooth, the undulations being strongest near the keel. The lobe-line of *P. Jullieni* as drawn by Pervinquière is reproduced in fig. 4 of Pl. VI. The sutures of the new species are present with but little variation in two more specimens of which the smallest has a diameter of about 60 mm.

Three specimens have been referred to this species.

Pelecodiscus capensis n.sp. Pl. V. fig. 11.

Shell discoidal, with closed umbilicus. Whorls much higher than broad and increasing rapidly in size. Greatest thickness of last whorl very close to the centre of the umbilicus. The lateral surface of the shell is slightly convex, the convexity being somewhat greater where the shell is thickest. The umbilicus is filled with shell-growth, which is raised in the centre to a kind of process. Around this process lies a groove-like concavity. The sides of the shell are slightly concave on both sides of the keel. The keel is sharp.

Little can be said of the ornamentation, for the greater part of the shell has disappeared. However, there are still indications of spiral-lines and growth-lines like those of *P. umzambiensis*. Undulations like those of *P. umzambiensis* are also present, together with undulations around the umbilicus, which are, however, not so pronounced as in *P. amapondensis*, described hereafter.

The lobe-line shows great resemblance with that of *P. umzambiensis*. The external lobe is deep and moderately broad. This lobe has two secondary lobes on each side, as in *P. umzambiensis*. The first lateral lobe, which is long and narrow, is shorter than the external one, its length being about three-quarters that of the last. Its posterior end reaches just as far backwards as the anterior secondary lobe of the external lobe. The second lateral lobe is very long and narrow. It is just as long as the external lobe, but it does not reach as far backwards. Along its outline are many small, secondary lobes and saddles. The third lateral lobe is short and about as broad as the second. Its length is about half that of the second lateral lobe and it reaches about half as far backwards. The fourth lateral lobe is slightly shorter and narrower than the third and reaches much further backwards. Its posterior end occupies about the same level as the posterior end of the second lateral lobe. The fifth lateral lobe is shorter than the fourth and this is about all that can be made out of it. This lobe is situated very close to the umbilical edge.

The two first lateral saddles are long and narrow. Secondary lobes cut deep into the body of the first one, but the second one is only fringed with small secondary lobes and saddles. The third lateral saddle is broader than the second. Both the second and the third lateral saddle are very superficially bifid, and the two arms of both saddles are even shallower bifid. The fourth lateral saddle is narrow and fairly long and bifidity is just indicated. The fifth lateral saddle is much shorter and also narrow; bifidity is just visible.

Measurements:

Diameter	about 53	mm.	(1·00)
Height of last whorl ...	„ 33	„	(0·62)
Thickness of last whorl	13	„	(0·25)

This species differs from the type of the genus and from *Pelecodiscus Jullieni* Pervinquière sp. by its long and narrow saddles and lobes external to the third lateral saddle. The internal portion runs much stronger backwards than in either of the other species. However, the differences are best seen by comparing the figures. It differs further from *P. umzambiensis* in the possession of undulations around the umbilicus.

Only one specimen of this species was found.

Pelecodiscus amapondensis n.sp. Pl. VII, figs. 1, 2.

Shell discoidal, with closed umbilicus. The umbilicus of the specimen is closed on one side, but not on the other. This seems to be an abnormal condition. It is supposed that the normal shell has a closed umbilicus at this stage. Whorls much higher than broad and increasing rapidly in size. Greatest thickness of last whorl situated at about one-quarter of the height of the whorl from the centre of the umbilicus. About three-quarters of a whorl earlier the greatest thickness lies very close to the centre of the umbilicus. The lateral surface of the whorl is convex where the shell is thickest. The left umbilicus is filled with shell-growth which is raised in the centre to a kind of process. Around this process lies a groove-like concavity. The lateral surface of the last whorl is only very slightly convex from where the shell is thickest towards the periphery. This portion of the lateral surface is actually flat at the beginning of the last whorl. Where the keel is preserved it is apparent that the lateral surfaces show practically no concavity along its sides. Only a small portion of the keel of the last whorl is preserved, and that at its beginning. This portion is blunt, broad and rounded, its thickness here being about 2·5 mm. The keel of the preceding whorl, which is visible about half a volution earlier than the described blunt keel, is sharp.

Nothing is preserved of any possible finer ornamentation of the shell. The undulations of the flank seem to be of the same type as those of *P. umzambiensis*; however, this species has also very prominent undulations immediately around the umbilicus.

The lobe-line greatly resembles that of *P. umzambiensis*. There is, however, some difference in the detail. The external lobe is probably similar to that of *P. umzambiensis*. The anterior secondary lobe of the external lobe is plainly visible as also a portion of the posterior one. The first lateral lobe, which is short and of moderate breadth, is much shorter than the external lobe, its length being about two-thirds that of the last. Its posterior end reaches just as far backwards as the anterior secondary lobe of the external lobe. The second lateral lobe is long and moderately broad. It is only slightly shorter than the external lobe, which, however, reaches much further backwards. The secondary saddles and lobes along its outline are of irregular length and breadth; there seems to be a tendency to bifidity. The third lateral lobe is short and broad. It is much shorter than the second lateral lobe and reaches about half as far backwards as the external lobe. There are many secondary lobes and saddles along its outline. The fourth lateral lobe is shorter and narrower than the third; it reaches slightly further backwards. The outer portion of its outline is modified by some small secondary lobes and saddles. From the fourth lateral lobe inwards there is a series of five small lobes, with a possible sixth on the umbilical edge. These lobes are more or less of the same length and breadth, the outer ones being slightly longer and broader than the inner ones, as far as visible. Counting from outwards, the third and fourth of these lobes may also be taken as one lobe with a large secondary saddle dividing it.

The three first lateral saddles are broad. The two first have a generally rounded anterior contour, while the third is rather broad and flattened anteriorly. The second saddle already shows a bifid arrangement, and the third is clearly bifid, while both its arms are also bifid. The fourth lateral saddle is much narrower than the third; it is bifid. The five small saddles inwards from the fourth are subequal. The outer ones are slightly longer and broader than the inner ones.

Measurements: the diameter of the last whorl cannot be obtained. The vector of the last whorl, where the sutures have been made visible, has probably a length of 54 mm. The thickness of the shell at this place is about 22 mm.

This species differs from the type especially in the blunt keel (of the later stage?) and the prominent undulations around the umbilicus. There is also difference in the lobe-line. The portion internal to the fourth lateral saddle in *P. amapondensis* is long and consists of five small saddles. In *P. umzambiensis* this portion is short and occupied by only one fairly large saddle. The fourth lateral saddle in *P. umzambiensis* is much broader than that in *P. amapondensis*. Further differences in the lobe-line may be gathered from the figures. The lobe-line shows differences with that of *Pelecodiscus Jullieni* Pervinquière sp. also. This will best be seen by comparison of the figures. The undulations of the shell near the umbilicus seem to be broader in our form than in the Algerian one.

This species is based on only one fragmentary specimen.

Genus SCHLOENBACHIA Neumayr emend. de Grossouvre.

Schloenbachia Umbulazi Baily sp.
1855. *Ammonites Umbulazi* Baily, **3**, p. 456, Pl. XI, fig. 4.
1871. *Ammonites Umbulazi* Griesbach, **5**, p. 63, Pl. III, fig. 1.
1904. *Muniericeras* (?) *Umbulazi* Solger, **16**, p. 205.
1906. *Schloenbachia Umbulazi* Woods, **17**, p. 336.

This species is remarkable for its variability, ranging from smooth to ribbed and tuberculated specimens. This inconstancy is not apparent from Baily's original description, nor from that of Griesbach and Woods. However, a slight indication of the presence of variation is given by the two last mentioned investigators, where they both state that the ribs are not so prominent as they appear to be in Baily's figure. Woods states that the type cannot be found, and therefore this judgment is based on evidence from other material.

I have now before me about 230 specimens of this species. There are amongst this lot specimens which agree more or less with the type, and others which are just like the specimen figured by Griesbach. It has been possible to arrange them into three series, two of which agree more or less with the specimens of Baily and Griesbach. Those agreeing with Baily's figures are by no means the most numerous, but, because of their agreement with the type, they will be taken as typical forms. The specimens agreeing with Griesbach's figure are regarded as a variety, which is named after Griesbach, who was the first to figure one of its representatives. The third series is a variety with still coarser tubercles and ribs than those of the typical form and will therefore be appropriately called var. *spinifera*.

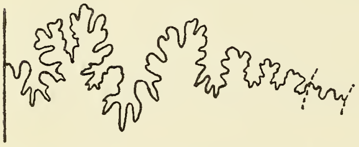
Schloenbachia Umbulazi Baily sp. var. *Griesbachi* n. var. Pl. VII, figs. 3, 4, Pl. VIII, figs. 1—5, text-figs. 17, 18.

Shell discoidal, umbilicated. Whorls strongly involute, high and narrow. Greatest thickness in young specimens near the umbilical edge; with advancing age the greatest thickness may wander to near the middle of the flanks, and in large specimens the greatest thickness lies actually in that position. The lateral surface of the whorls is slightly convex in very young shells. It is very soon divided into two portions by an extremely low and broad ridge, situated at or slightly internal to the middle of the flanks. This ridge often develops, especially in larger shells, into a broad, slightly convex zone. In the early stages the inner portion of the surface is flat and that of the one side is practically parallel with that of the other. In later stages the inner portions of the two surfaces diverge slightly outwards and in large shells these portions are also slightly concave. The outer portion of the flanks is practically flat; sometimes it is very slightly convex and sometimes even very slightly concave. Very young shells have no keel; the external surface is then smooth and evenly and strongly convex, the keel only commencing at a diameter of about 1 cm. In the smaller specimens this keel is nothing else but the sharp edge in which the flanks meet, but in the largest specimen it is a high and narrow crest. Soon after the commencement of the keel a shoulder is formed on the flanks, very close to the keel. In large shells this shoulder is less pronounced than in younger ones and on the last whorl of our largest specimen it has practically become a strongly convex portion of the flank. The umbilical edge is smooth in very young specimens. In practically all the specimens of medium size the edge of the umbilicus bears a row of tubercles. These do not start at a fixed period for they are present in fairly small shells, while they have not yet appeared in larger specimens. In all three types the relative height of the last whorl decreases with advancing age, while at the same time the relative diameter of the umbilicus increases.

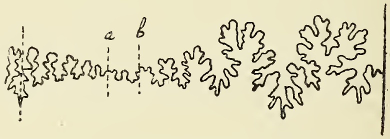
The flanks are covered by growth-lines, which are slightly concave forwards near the umbilicus, strongly convex forwards on or near the middle of the flanks and strongly concave forwards in their outer half. In young specimens this is practically the only ornamentation of the flanks. Sometimes, however, the surface of the flanks has a wavy appearance through the possession of extremely low and broad ribs and interspaces, which have the same course as the growth-lines. These waves are generally less conspicuous on the inner portion than on the outer portion of the flanks. They are sometimes so clear, that some of them are seen to originate at the umbilical tubercles, while others apparently only start on the middle of the flanks. These ribs may be very conspicuous at the shoulder near the keel, but they do not cut this shoulder up into tubercles.

Large specimens show broad, shallow constrictions on the cast, probably old mouth-edges. They have the same shape as the growth-lines. On the outer surface of the shell these old mouth-edges are represented by a thickened rib, which seems to border the groove on the cast behind.

The lobe-line differs from that given by Baily and by Griesbach, Baily's figure being nearly correct. The first lateral lobe is longer than the external lobe and stands obliquely on the axis of the lobe-line. The first lateral and the auxiliary lobes are trifid. The second lateral lobe is irregular, all its secondary lobes having more or less the same length. The external lobe is broad. The external saddle and the first lateral saddle are practically of the same length. The second lateral saddle is small and forms with the four auxiliary saddles a series, which gradually diminishes in height. There are five auxiliary lobes, which gradually diminish in length towards the umbilicus. The axis of the lobe-line is practically straight. The internal portion of the lobe-line has been developed in a small specimen. There are five internal saddles, which gradually diminish in height from the antisiphonal lobe towards the umbilical suture. There are also five internal lobes, which obey the same law. The antisiphonal lobe is narrow and longer than any of the five internal lobes.



Text-fig. 17. *Schloenbachia Umbulazi* var. *Griesbachi*. Lobe-line of paratype up to the umbilical suture on a radius of 16 mm. ×3.



Text-fig. 18. *Schloenbachia Umbulazi* var. *Griesbachi*. Lobe-line of paratype from dorsal to ventral line, on a radius of about 13 mm. ×3. *a* = umbilical suture; *b* = umbilical edge.

Measurements:

	Type		
Diameter	95·5 mm. (1·00)	69·5 mm. (1·00)	47·7 mm. (1·00)
Height of last whorl ...	45 ,, (0·47)	35·2 ,, (0·51)	25·6 ,, (0·54)
Thickness of last whorl ...	21·7 ,, (0·23)	15 ,, (0·22)	11·7 ,, (0·25)
Height of penult. whorl ...	24·6 ,, (0·26)	16·9 ,, (0·24)	10·6 ,, (0·22)
Thickness of penult. whorl	19 ,, (0·20)	13·1 ,, (0·19)	5·7 ,, (0·12)
Diameter of umbilicus ...	16·9 ,, (0·18)	10 ,, (0·14)	6·6 ,, (0·14)

Diameter	26·8 mm. (1·00)	16·3 mm. (1·00)
Height of last whorl	14 ,, (0·52)	8·9 ,, (0·55)
Thickness of last whorl ...	6·7 ,, (0·25)	4·6 ,, (0·28)
Height of penultimate whorl ...	5·7 ,, (0·21)	3 ,, (0·18)
Thickness of penultimate whorl	3·7 ,, (0·14)	2·7 ,, (0·17)
Diameter of umbilicus... ...	3·7 ,, (0·14)	2·2 ,, (0·14)

The largest specimen is regarded as the type, the other specimens as paratypes.

Schloenbachia Umbulazi Baily sp. Forma typica. Pl. VIII, figs. 6—9; Pl. IX, figs. 1, 2.

The typical form differs from the just described variety in the ornamentation. The ribs are stronger; they start broad and low from the umbilical tubercles. Old mouth-edge grooves are deep and broad in larger shells, and cut up the inner portion of the flanks into thick and broad convexities. On the outer portion of the flanks the number of ribs is augmented by intercalation of shorter ones. On the shoulder near the keel these ribs form low tubercles, elongated in the direction of the rib. There are three or four shoulder tubercles to every tubercle on the umbilical edge. The largest specimen shows a portion of the last mouth-edge. It is curved in the same way as the growth-lines and the keel runs out into a sharp point. The living chamber occupies five-twelfths of the last whorl. I did not find any difference in the lobe-line.

Measurements:

	Neoparatype	Neotype	Neoparatype
Diameter	58·4 mm. (1·00)	45·9 mm. (1·00)	33·1 mm. (1·00)
Height of last whorl ...	29·2 ,, (0·50)	23·6 ,, (0·51)	17·5 ,, (0·53)
Thickness of last whorl ...	15 ,, (0·26)	13·8 ,, (0·30)	8·3 ,, (0·25)
Height of penult. whorl ...	13·5 ,, (0·23)	10·8 ,, (0·24)	6·8 ,, (0·21)
Thickness of penult. whorl	8 ,, (0·14)	6·4 ,, (0·14)	4·3 ,, (0·13)
Diameter of umbilicus ...	9 ,, (0·15)	6·7 ,, (0·15)	5 ,, (0·15)

Thirteen specimens of this form have been picked out of the total number of this species mentioned above. Woods states that the type of *Schloenbachia Umbulazi* Baily sp. cannot be found (**17**, p. 337). I will therefore pick as neotype the second specimen measured, while the other specimens may be regarded as paratypes to this neotype, and may therefore be called neoparatypes.

Schloenbachia Umbulazi Baily sp. var. *spinifera* n. var. Pl. IX, figs. 3—7.

In some cases this variety closely resembles the typical form, but it differs from the type in the following respects: its umbilical tubercles are large and high, even in small forms. Its ribs are strong and especially in small forms curved somewhat less than those of the type; the shoulder tubercles are also fairly prominent. The flanks of the smaller forms are fairly flat, those of the end of the last whorl of the largest specimen are slightly convex. The greatest thickness of the whorl lies at the umbilical edge. The relative height of the last whorl seems to be generally slightly less than that of the other types. The relative thickness of the whorls and the relative diameter of the umbilicus is greater than in the other types. The lobe-line of the large specimen has been developed, but its preservation is bad. The lobe-line of a smaller specimen shows no striking differences with that of the other types.

Measurements:

	Type		
Diameter	65 mm. (1·00)	29·7 mm. (1·00)	27·3 mm. (1·00)
Height of last whorl ...	29·8 ,, (0·46)	15·4 ,, (0·52)	13·8 ,, (0·51)
Thickness of last whorl ...	20 ,, (0·31)	10·9 ,, (0·36)	9 ,, (0·33)
Height of penult. whorl ...	16 ,, (0·25)	6·8 ,, (0·23)	5·9 ,, (0·22)
Thickness of penult. whorl	10·8 ,, (0·17)	6 ,, (0·20)	4·6 ,, (0·17)
Diameter of umbilicus ...	15·7 ,, (0·24)	5·7 ,, (0·19)	4·8 ,, (0·18)

Diameter	26·8 mm. (1·00)	26 mm. (1·00)
Height of last whorl	12·9 ,, (0·48)	12 ,, (0·46)
Thickness of last whorl ...	8·5 ,, (0·32)	10·3 ,, (0·40)
Height of penultimate whorl ...	5·6 ,, (0·21)	5·7 ,, (0·22)
Thickness of penultimate whorl	4 ,, (0·15)	5·7 ,, (0·22)
Diameter of umbilicus... ...	5 ,, (0·19)	5·7 ,, (0·22)

Six specimens of this variety are present, the largest of which has been taken as the type.

The large specimens of var. *Griesbachi* resemble somewhat *Schloenbachia Fournieri* de Gross. (**10**, Pl. XXXV, fig. 1). They, however, do not possess the shoulder tubercles of this species. The small specimens of var. *spinifera* look remarkably like the side view of *Muniericeras Lapparenti* de Gross. (*l.c.*, fig. 3). Our specimens differ especially from *Schloenbachia Blanfordiana* Stol. sp. (**4**, p. 46, Pl. XXVI) in the absence of the row of tubercles on the middle of the flanks, which characterizes this species.

Two pathological specimens have been found, both apparently belonging to the variety *Griesbachi*. In both the keel is not in the plane of symmetry, having moved, more or less, on to one of the flanks. In one specimen this has taken place to such an extent, that the ribs of one side pass over the outer contour on to the other side. As a result the outer contour is somewhat wavy.

Genus MORTONICERAS Meek.

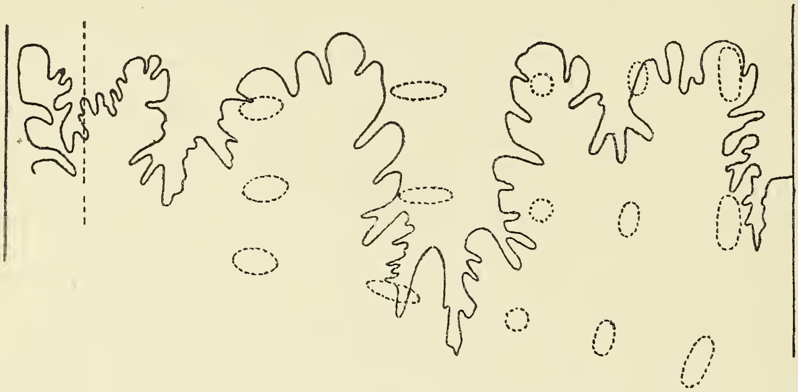
Mortoniceras Soutoni Baily sp. Pls. X, XI, text-figs. 19—22.
1855. *Ammonites Soutonii* Baily, **3**, p. 455, Pl. XI, fig. 1.
1895. *Mortoniceras Soutoni* Kossmat, **12**, p. 88.
1904. *Mortoniceras? Soutoni* Solger, **16**, p. 205.
1906. *Mortoniceras Soutoni* Woods, **17**, p. 337, Pl. XLIII, fig. 1.

There are four fairly complete specimens and a fragment of a larger one of this species in the museum collection. Three of these were bought from Mr Venter, another was presented by Mr D. Strachan, while the last was found by the Museum Expedition. A description in extenso of this species will not be out of place.

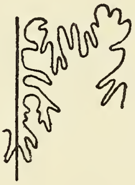
Shell discoidal, umbilicated, consisting of numerous whorls, which increase moderately in size. Whorls higher than broad. Greatest thickness between the umbilical edge and the middle of the flanks, but nearer to the last. External surface convex, flanks also convex, but their inner two-thirds only very slightly so. There is no demarcation between the external surface and the flanks, unless the row of elongated tubercles on each side of the keel is taken as such. The high umbilical surface is convex, but as a whole practically vertical on the plane of symmetry. Between the umbilical surface and the flank the surface of the shell is only strongly convex, there being no definite edge. Involution about one-fourth. Umbilicus large.

The external surface of the shell is ornamented by a continuous keel. This is bordered on both sides by a broad, shallow groove. The flanks are covered by numerous more or less radial ribs. In one specimen these ribs are slightly concave forwards over their whole length and on every part of the shell. In two other specimens they are fairly straight on the early stages, while on the last whorl they become convex forwards on the middle of the flanks, and slightly concave forwards on the outer and on the inner portion of the flanks. They start at the middle of the umbilical surface in a strongly backward direction and they terminate on reaching the grooves on the external surface. The ribs are comparatively broad and low; they are highest at the umbilical edge and only just visible at their external end. They are separated by very broad, shallow interspaces. The ribs are ornamented by a series of tubercles, which are placed in five spiral rows over the shell. The inner row is situated at the umbilical edge. The tubercles of this row are high, narrow and radially elongated. On the earlier whorls, especially of one specimen where they have not suffered from weathering, they are seen to end in a sharp point. On the later whorls they lose this extreme acuteness. The second row is situated near the middle of the flanks. It is not present in the very early stages of the shell. At a diameter of from 12 cm. to 15 cm. its tubercles are small knobs, which are much lower than the tubercles of the first row and which have a radially elongated upper edge. On later whorls these tubercles are represented by a slight thickening of the ribs and on the end of the last whorl of our largest specimen even this thickening has disappeared; however, this portion shows signs of old age, the ribs having become irregular and flattened and in places even having been reduced to mere wrinkles. The third row is situated external to and at some distance from the middle of the flank. In the early stages of the shell the involution is such, that the preceding whorl is covered by the following one up to the third row of tubercles. The tubercles are then drawn out into long spines, which lean against the umbilical surface of the following whorl. On the cast these spines are only represented by high rounded tubercles. The row of tubercles diverges slightly forwards with the umbilical suture and, therefore, in later stages the row is separated from the umbilical surface of the following whorl. The spines become shorter as the separation becomes greater. On the last stages of the shell these tubercles have been reduced to a mere thickening of the rib, which, however, is even then thicker and higher than the corresponding tubercle of the second row. The upper edges of the spines and tubercles of this row are spirally elongated. The fourth row of tubercles is completely covered up by the later whorls in the young stages of the shell. This row is situated close to the third one and it appears as soon as the third row of tubercles and the umbilical suture are a short distance apart; but even then they do not appear completely. On the last whorl they appear to be thick and fairly high tubercles, with a moderately long, transversely elongated upper edge. The fifth row is only visible on the last whorl. It lies slightly nearer to the keel than to the fourth row. The fourth row lies practically midway between the third and the fifth. The tubercles of the fifth row are high, radially very narrow and transversely very long.

The lobe-line of three of our specimens (of the other two specimens they were not developed) differs considerably from that given by Baily. It also differs from the lobe-line drawn by Woods. The external saddle is large. It is cut into two by a secondary lobe, which passes far backwards in one instance, but which is very small in another. The two portions are practically equal in one, while in the two others the inner portion is smaller than the outer. The first lateral saddle is just as high or higher than the external saddle. It is sometimes divided into two unequal portions; in one specimen it is irregularly cut up by small secondary lobes. In two specimens the ventral lobe is nearly as long as the first lateral lobe, in the other it is much shorter. It sends a long process backwards on each side of the broad, truncated, siphonal saddle. The first lateral lobe is very long and of moderate breadth. In one specimen it is rather narrow. This lobe is not only bifid, but it terminates with two very long, narrow, subequal, backward processes. The second lateral lobe is much shorter than the first and it is also shorter than the external lobe; it is narrow and terminates in a point. In one specimen it is situated on the umbilical row of tubercles; in another specimen it lies completely external to this row and in the third specimen it lies internal to the row. The second lateral saddle lies completely on the umbilical surface in two specimens; in the third specimen it lies partly on the flanks. It is shorter than the internal side of the first lateral saddle. Its breadth varies in the three specimens. In the specimen in which it passes on to the flanks its inner side lies internal to the umbilical suture and its breadth as visible is greater than that of the first lateral saddle. In another specimen the breadth of its visible portion equals that of the first lateral saddle, and in the third specimen, which shows the dorsal surface of its last whorl, the second lateral saddle is much narrower than the first. The broad second lateral saddles are divided into two unequal parts by a short secondary lobe. The external portion of the saddle is broader than the internal portion. The first dorsal lobe is moderately long and very narrow; it is much shorter than the second lateral lobe. The dorsal saddle is very narrow; it is deeply cut into by two secondary lobes of the antisiphonal lobe, which very nearly meet two secondary lobes of the first dorsal lobe. In its undamaged state it reaches

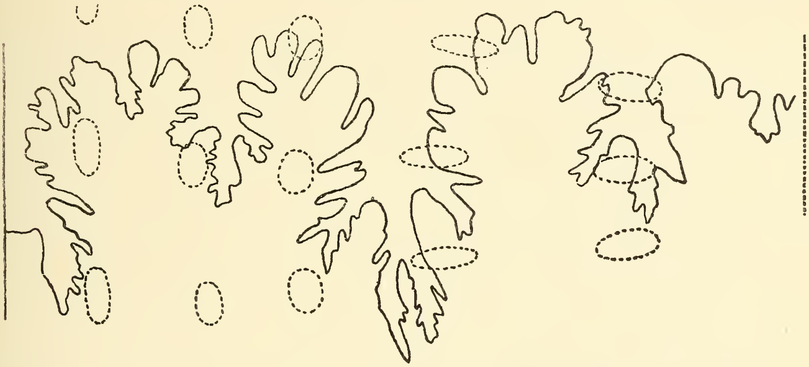


Text-fig. 19. *Mortoniceras Soutoni*. Lobe-line of plesiotype from dorsal to ventral line. Specimen with very narrow second lateral saddle. Radius about 12 cm. Nat. size.

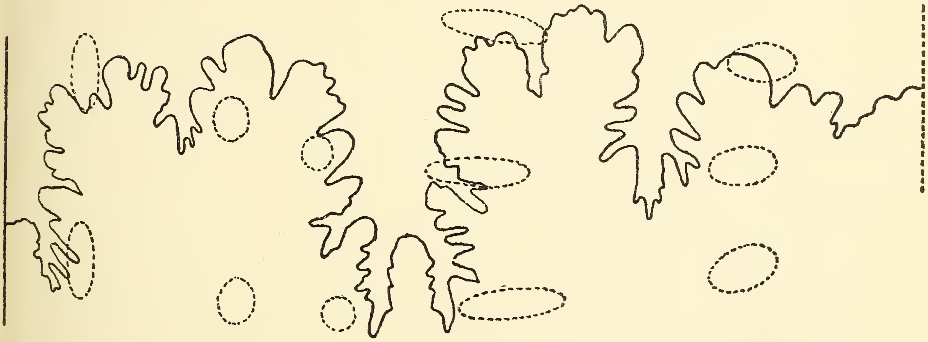


Text-fig. 20. *Mortoniceras Soutoni*. Dorsal lobe, dorsal saddle and second lateral saddle of the same specimen as fig. 19. Radius about 8 cm. Nat. size.

slightly further forwards than the second lateral saddle. Its most anterior portion is very thin and is easily broken. The antisiphonal lobe is very long and very narrow. It sends a short secondary lobe outwards and slightly backwards into the upper end of the dorsal saddle. Further backwards it sends a longer secondary lobe with a slightly backward direction into the dorsal saddle: further backwards still, it sends another long secondary lobe backwards and slightly outwards. This secondary lobe reaches very far backwards. The posterior end of the latter is apparently bifid. However, practically only one side of the antisiphonal lobe is preserved, and it is apparently not symmetrical.



Text-fig. 21. *Mortoniceras Soutoni*. Lobe-line of specimen with broader second lateral saddle than that of fig. 19, up to the umbilical suture. Radius 12 cm. Nat. size.



Text-fig. 22. *Mortoniceras Soutoni*. Lobe-line of specimen with still broader second lateral saddle, up to the umbilical suture. Radius 14·5 cm. Nat. size.

It is therefore possible that the unknown side may be somewhat differently built, although the described side is constant over practically a whole whorl.

Notwithstanding these differences in the lobe-lines I can see no reason to regard these specimens as different species. I have not been so much impressed by the differences, that I can regard them as being anything but individual peculiarities. This being the case, one has to accept the alternative, that the lobe-line may suffer considerable changes in different individuals of the same species, and that therefore the comparative constancy of the lobe-line at more or less the same age is, at least in some cases, fiction.

Measurements:

	A		B		C	
Diameter	261 mm.	(1·00)	323 mm.	(1·00)	232 mm.	(1·00)
Height of last whorl ...	90 ,,	(0·35)	110 ,,	(0·34)	72 ,,	(0·31)
Thickness of last whorl ...	70 ,,	(0·27)	90 ,,	(0·28)	54 ,,	(0·23)
Height of penult. whorl...	48 ,,	(0·18)	60 ,,	(0·19)	34 ,,	(0·15)
Thickness of penult. whorl	32 ,,	(0·12)	46 ,,	(0·14)	—	—
Diameter of umbilicus ...	108 ,,	(0·41)	136 ,,	(0·42)	108 ,,	(0·47)

A. Specimen with broadest second lateral saddle.
B. Specimen with narrower second lateral saddle.
C. Specimen with narrowest second lateral saddle.

The outer portion of the lobe-line of this species shows a great resemblance with that of *Acanthoceras*, especially with that of the group of *A. Deverianum* d'Orb. The lobe-line of *A. Deveroide* de Gross. as given by Kossmat (**12**, p. 125), corresponds remarkably well with that of the present species. Except for the presence of a row of tubercles in the place of a keel, the type of ornamentation agrees also fairly well. It is a pity that the complete lobe-line of the mentioned species is not known. The inner portion of the lobe-line of the present species differs considerably from that of *A. Newboidi* Kossmat for example (**12**, Pl. XIV, fig. 2), especially through the presence of two dorsal saddles.

Without doubt this species belongs to the genus *Mortoniceras* Meek. It corresponds very well with the diagnosis given by Pervinquière (**18**, p. 227). However, Pervinquière states, that the first lateral lobe has practically the same length as the external lobe, and this does not agree at least with one of our specimens, in which the external lobe is much shorter than the first lateral lobe, as in *Acanthoceras ornatissimum* Stol. Pervinquière says, that the first lateral lobe is bifid or at least ends in two equal points. De Grossouvre (**10**, p. 66) goes further and states, that the end of the first lateral lobe is rounded and that its secondary lobes are sub-equal, that is to say, the characteristic terminal fork of the lobe in *Acanthoceras* and *Stoliczkaia* is not present or, at the most, only indicated. A comparison with the lobes figured of our specimens shows, that they do not agree with this description, on the contrary, they agree in this respect remarkably well with the lobe-line of the genus *Peroniceras* de Grossouvre (**10**, p. 93). Pervinquière has pointed out, that the beautiful forking of the first lateral lobe of *Peroniceras* occurs also in *Gauthiericeras* de Grossouvre (**18**, p. 249). Our specimens now prove, that it is neither a distinctive character between *Peroniceras* and *Mortoniceras*. The only other character by which *Peroniceras* can be distinguished from *Mortoniceras* is the possession of three keels instead of one. However, Kossmat has shown (**12**, p. 88), that *Mortoniceras Stangeri* Baily sp. is a typical *Peroniceras* de Grossouvre in its young stage, and Pervinquière mentions the fact (**18**, p. 248), that in the young stage there is but one keel in the genus *Peroniceras* and that each of the lateral keels may be replaced by a row of tubercles in the adult. The possession of three keels instead of one cannot, apparently, be considered to be a character, which is of generic value, at least in this case. There are, therefore, no characters which distinguish the genus *Peroniceras* from *Mortoniceras* and the first has, therefore, to be regarded as a synonym of the last.

Another question is whether the relation between *Acanthoceras* and *Mortoniceras* is not closer than generally accepted. The most weighty character, separating these two genera into different families is the possession of a keel. Mention has been made above of the group of *Acanthoceras Deverianum* which has a row of tubercles instead of a keel. After *Peroniceras* has shown us how keels change into tubercles it seems necessary to investigate this matter further. However, as I cannot lay my hands on specimens of the group of *Acanthoceras Deverianum,* I shall have to leave this to some other investigator, who is in more favourable circumstances.

AGE AND AFFINITY OF THE FAUNA.

The Pondoland expedition has shown the Umzamba Beds to contain a wealth of ammonites. Twenty new forms have been found, bringing the total number of described Pondoland ammonites, of which Woods only enumerated thirteen, up to thirty-eight, including the five species recently described. Among the new forms is a new genus and two genera, which are recorded from Pondoland for the first time. Of six other genera, which were only represented by material insufficient for identification, definite species have been found. With such a large addition to the known fauna it seems necessary to restudy its affinities and its age.

Attention has repeatedly been drawn to the close resemblance between the Cretaceous faunas of Pondoland and Southern India. Kossmat even calls the resemblance between the most widely separated deposits of the Indo-Pacific Province, namely Natal, Vancouver and Quiriquina, striking (**13**, p. 73). De Grossouvre, however, expressed the opinion, that there is at least just as much affinity of the Pondoland Cretaceous fauna with that of Europe as with that of Southern India. Woods regards the resemblance greater with Southern India than with Europe.

These opinions have in the first place been based upon the presence of identical forms in the different deposits. According to Woods the following ammonites are common to Southern India and Pondoland:

Gaudryceras Kayei Forbes sp.
Pseudophyllites Indra Forbes sp.
Hamites subcompressus Forbes.
Hamites indicus Forbes.
Hauericeras Gardeni Baily sp.
Hauericeras Rembda Forbes sp.

However, the author states that all of these, except the two *Hamites* spp. are widely distributed forms. The *Gaudryceras Kayei* of Pondoland has now been shown to belong to another species. According to de Grossouvre *Pseudophyllites Indra* and *Gaudryceras Colloti* of France are identical. *Hauericeras Gardeni* and *Hauericeras Rembda* are also found in other localities. Actually, therefore, the two areas have only two *Hamites* spp. in common, which do not occur anywhere else. It is very doubtful whether great weight should be attached to this evidence.

If we compare the Pondoland fauna with that of the Cretaceous of Northern Africa, we find the following species in common:

Hauericeras, cf. *Gardeni* Baily sp.
Hauericeras Rembda Forbes sp.
Scaphites Cunliffei Forbes sp.

All these species occur in Southern India also.

As regards the occurrence of genera, it has been pointed out that *Mortoniceras* is abundant in Pondoland, but apparently absent in Southern India. The absence of *Pachydiscus* in Pondoland was formerly regarded as another difference with the Indian fauna; since the discovery of *Pachydiscus* in Pondoland, however, this difference no longer exists. A further difference is the absence of *Eulophoceras* and *Pelecodiscus* in India.

The genera *Mortoniceras* and *Pelecodiscus* occur in Northern Africa; *Eulophoceras* is not known outside Pondoland.

Taking into account the allied forms, it will be found from the list following hereafter, that the fauna of the Pondoland Cretaceous is represented by twenty-two allied and identical forms in Southern India and by thirteen of such forms in Northern Africa, while the number of allied and identical forms in Northern Africa and Europe combined amounts to at least twenty-five. Therefore, as far as quantity is concerned, one can only conclude, that the fauna of Pondoland shows the same affinity to the Cretaceous fauna of Northern Africa as to that of Southern India. The presence of *Mortoniceras* and *Pelecodiscus* in Northern Africa and Pondoland and their absence in India seem to indicate, that the connection of the two former localities was more direct. Possibly the solution of the problem may be found in the existence of a direct, uninterrupted coastline between Northern Africa and Pondoland, or perhaps the two localities were connected by shallow seas, while the shortest connection between Southern India and Pondoland was across the Indian Ocean.

It is difficult to ascertain the exact age of the fauna because one has to deal mostly with allied forms. However, we may first of all draw some negative conclusions. *Nautilus danicus* is apparently absent and therefore it is extremely probable, that the uppermost Cretaceous is not represented. On the other hand, *Hoplitoides, Pseudotissotia, Barroisiceras, Tissotia* and similar genera have not been found in Pondoland, and therefore it is extremely probable, that the Turonian and the lower portion of the Senonian, the Coniacian, are not represented.

If we compare with Southern India (see list following hereafter) we find the following number of species and allied species in the respective groups:

2 + 3	Lower Ariyalur Group.
10	Valudayur Beds.
6	Upper Trichinopoly Group.
1	Trichinopoly Group.
1	Upper Utatur Group.
3	Lower Utatur Group.

The horizons of three species have been given as Ariyalur, but as no ammonites have been found above the Megalosaurus Beds in India these have also been taken as Lower Ariyalur. At the most therefore, there are in Southern India eleven species below the Lower Ariyalur Beds, which are allied to Pondoland forms, while there are fifteen such species in these beds. All six identical forms mentioned in the list occur in the Lower Ariyalur Beds and only one of them, *Hauericeras Gardeni*, may also occur in the Upper Trichinopoly Beds. Apparently the Pondoland Beds are, therefore, of the same age as the Lower Ariyalur Beds.

In Northern Africa we find the allied species distributed as follows:

1	Danian.
2	Campanian.
4	Upper Santonian.
4	Santonian.
1	Coniacian.
2	Vraconnian.

Of the identical species two occur in the Upper Santonian and one in the Danian. The affinity appears therefore to be greatest with the Upper Santonian.

In Europe the allied species are distributed as follows:

3 Upper Campanian.
2 Lower Campanian.
3 Upper Santonian.
4 Santonian.
2 Coniacian.
1 Turonian.

There are no identical forms, and we can only conclude, that the Pondoland deposits show the greatest resemblance with the Upper Santonian of Europe.

The Lower Ariyalur Beds being equivalent with the Lower Campanian we come to the result that the Cretaceous deposits of Pondoland are to be correlated on the one side with the Lower Campanian and on the other with the Upper Santonian.

I am inclined to regard the Pondoland Beds as of Upper Santonian age, because it seems as if the close resemblance between *Gaudryceras Rouvillei* de Gross. (Sant.) and *G. Sigcau* mihi, *Desmoceras pyrenaicum* de Gross. partim (Sant.) and *D. simplex* mihi, *D. pyrenaicum* de Gross. partim (Sant.) and *D. crassum* mihi, carries just as much weight as the few identical forms in the two faunas, of which only a couple have not been found below the Ariyalur Beds. Further, the resemblance between *Pelecodiscus Jullieni* Pervinquière sp. and *Pelecodiscus umzambiensis* mihi is so great, that the shortest possible separation in time seems to be the most likely. The same would hold good for the resemblance between *Schloenbachia Fournieri* de Gross. and *S. Umbulazi* var. *Griesbachi* mihi.

Kossmat regarded the Pondoland deposits to represent the Upper part of the Trichinopoly Group (Santonian) as well as the Ariyalur Group (Campanian). de Grossouvre places them at the limit of the Coniacian and Santonian divisions, while Woods correlates them with the Ariyalur Group.

DISTRIBUTION OF THE SPECIES OR ALLIED FORMS.

Pondoland	Southern India		Northern Africa		Europe	
Nautilus						
Woodsi v. Hoepen						
Phylloceras						
umzambiense v. Hoepen	*P. Forbesianum* Forbes sp. *P. ellipticum* Kossmat	L. Ut.-Val. L. Ut.				
Woodsi v. Hoepen	*P. Nera*	Val.	—	—	*P. Velledaeformis* Schlüter sp.	U. Camp.
Gaudryceras						
tenuilineatum v. Hoepen	*G. subtililineatum* Kossmat	Ar.				
varicostatum v. Hoepen	—	—	*G. Kayei* Forbes sp. *G. striatum?* Jimbo	Sant. U. Sant.		
Sigcau v. Hoepen	—	—	—	—	*G. Rouvillei* de Gross.	U. Sant.
amapondense v. Hoepen						
Tetragonites						
teres v. Hoepen						
superstes v. Hoepen	*T. Timotheans* Mayor sp.	L. Ut.	*T. Timotheanus* Mayor sp.	Vrac.		
virgulatus v. Hoepen	*T. epigonus* Kossmat	U. Trich.	*T. epigonus* Kossmat	Sant.		
nuperus v. Hoepen	*T. Cala* Forbes sp. *T. Kingianus* Kossmat	Val. U. Ut.	*T. Cala* Forbes sp. *T. aff. Kingianus* Kossmat	Sant. Vrac.		
Pseudophyllites						
indra Forbes sp.	×	Val.	—	—	*Gaudryceras Colloti* de Gross.	U. Camp.
Hamites						
amapondensis v. Hoepen						
subcompressus Forbes	×	Val.				
indicus Forbes	×	Val.				
Heteroceras						
amapondense v. Hoepen						
Baculites						
Sulcatus Baily	—	—	—	—	*B. incurvatus* Duj.	U. Sant. L. Camp.
Bailyi Woods	*B. teres* Forbes	Val.				
capensis Woods						

Desmoceras						
simplex v. Hoepen	*D. diphylloides* Forbes sp.	Val. Ar.	*D. diphylloides* Forbes sp.	U. Sant. Camp.	*D. pyrenaicum* de Gross. partim	Sant.
crassum v. Hoepen	—	—	—	—	*D. pyrenaicum* de Gross. partim	Sant.
compactum v. Hoepen	*D. sugata* Forbes sp.	U. Trich. L. Ar.				
Holcodiscus						
africanus v. Hoepen	*H. karapadensis* Kossmat	L. Ar.				
Faku v. Hoepen	*H. Buddhaicus* Kossmat	U. Trich.				
Pachydiscus						
antecursor v. Hoepen	*P. Jimboi* Kossmat	Trich.	—	—	*P. peramplus* Mant.	Turoon
simplex v. Hoepen	*P. Cricki* Kossmat	U. Trich.	*P. selbiensis* Pervinquière	Sant.		
Hauericeras						
Gardeni Bailey sp.	×	U. Trich. Ar.	*H.* cf. *Gardeni* Baily sp.	U. Sant.	*H. Fayoli* de Gross. *H. Welschi* de Gross. *H. pseudo-Gardeni* Schlüter	U. Camp. Sant. U. Sant. L. Camp.
Rembda Forbes sp.	×	Val.	×	U. Sant.		
Scaphites						
Cunliffei Forbes sp.	×	Val.	×	Danien		
sp.	*S. andurensis* Stol. sp.	U. Trich.				
Eulophoceras						
natalense Hyatt						
Pelecodiscus						
umzambiensis v. Hoepen *capensis* v. Hoepen *amapondensis* v. Hoepen	—	—	*P. Jullieni* Pervinquière sp.	Con.		
Schloenbachia						
Umbulazi Baily sp. var. *Griesbachi* v. Hoepen forma typica var. *spinifera* v. Hoepen	—	—	—	—	*S. Fournieri* de Gross.	Con.
Mortoniceras						
Soutoni Baily sp. *Stangeri* Baily sp.	—	—	*M. delawarense* Morton	Camp.	Different species	Con. Sant.

DISTRIBUTION OF THE SPECIES OR ALLIED FORMS.

Pondoland	Southern India		Northern Africa		Europe	
Nautilus						
Woodsi v. Hoepen						
Phylloceras						
umzambiense v. Hoepen	*P. Forbesianum* Forbes sp. *P. ellipticum* Kossmat	L. Ut.-Val. L. Ut.				
Woodsi v. Hoepen	*P. Nera*	Val.	—	—	*P. Velledaeformis* Schlüter sp.	U. Camp.
Gaudryceras						
tenuilineatum v. Hoepen	*G. subtililineatum* Kossmat	Ar.				
varicostatum v. Hoepen	—	—	*G. Kayei* Forbes sp. *G. striatum?* Jimbo	Sant. U. Sant.		
Sigcau v. Hoepen	—	—	—	—	*G. Rouvillei* de Gross.	U. Sant.
amapondense v. Hoepen						
Tetragonites						
teres v. Hoepen						
superstes v. Hoepen	*T. Timotheans* Mayor sp.	L. Ut.	*T. Timotheanus* Mayor sp.	Vrac.		
virgulatus v. Hoepen	*T. epigonus* Kossmat	U. Trich.	*T. epigonus* Kossmat	Sant.		
nuperus v. Hoepen	*T. Cala* Forbes sp. *T. Kingianus* Kossmat	Val. U. Ut.	*T. Cala* Forbes sp. *T. aff. Kingianus* Kossmat	Sant. Vrac.		
Pseudophyllites						
indra Forbes sp.	×	Val.	—	—	*Gaudryceras Colloti* de Gross.	U. Camp.
Hamites						
amapondensis v. Hoepen						
subcompressus Forbes	×	Val.				
indicus Forbes	×	Val.				
Heteroceras						
amapondense v. Hoepen						
Baculites						
Sulcatus Baily	—	—	—	—	*B. incurvatus* Duj.	U. Sant. L. Camp.
Bailyi Woods	*B. teres* Forbes	Val.				
capensis Woods						
Desmoceras						
simplex v. Hoepen	*D. diphylloides* Forbes sp.	Val. Ar.	*D. diphylloides* Forbes sp.	U. Sant. Camp.	*D. pyrenaicum* de Gross. partim	Sant.
crassum v. Hoepen	—	—	—	—	*D. pyrenaicum* de Gross. partim	Sant.
compactum v. Hoepen	*D. sugata* Forbes sp.	U. Tricb. L. Ar.				
Holcodiscus						
africanus v. Hoepen	*H. karapadensis* Kossmat	L. Ar.				
Faku v. Hoepen	*H. Buddhaicus* Kossmat	U. Trich.				
Pachydiscus						
antecursor v. Hoepen	*P. Jimboi* Kossmat	Trich.	—	—	*P. peramplus* Mant.	Turoon
simplex v. Hoepen	*P. Cricki* Kossmat	U. Trich.	*P. selbiensis* Pervinquière	Sant.		
Hauericeras						
Gardeni Bailey sp.	×	U. Trich. Ar.	*H.* cf. *Gardeni* Baily sp.	U. Sant.	*H. Fayoli* de Gross. *H. Welschi* de Gross. *H. pseudo-Gardeni* Schlüter	U. Camp. Sant. U. Sant. L. Camp.
Rembda Forbes sp.	×	Val.	×	U. Sant.		
Scaphites						
Cunliffei Forbes sp.	×	Val.	×	Danien		
sp.	*S. andurensis* Stol. sp.	U. Trich.				
Eulophoceras						
natalense Hyatt						
Pelecodiscus						
umzambiensis v. Hoepen	—	—	*P. Jullieni* Pervinquière sp.	Con.		
capensis v. Hoepen						
amapondensis v. Hoepen						
Schloenbachia						
Umbulazi Baily sp. var.						
Griesbachi v. Hoepen	—	—	—	—	*S. Fournieri* de Gross.	Con.
forma typica						
var. *spinifera* v. Hoepen						
Mortoniceras						
Soutoni Baily sp.	—	—	*M. delawarense* Morton	Camp.	Different species	Con. Sant.
Stangeri Baily sp.						

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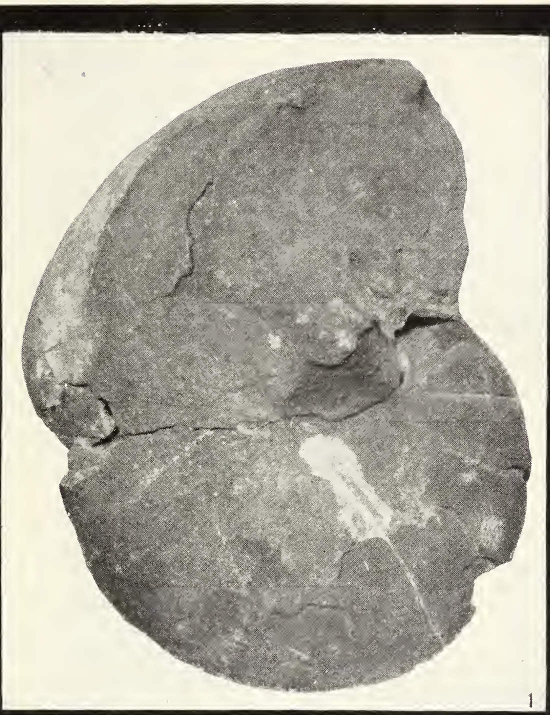
PLATES I TO XI

PLATE I.

Nautilus Woodsi v. Hoepen.

Fig. 1. Lateral view of paratype. × ½.
,, 2. Lateral view of type. Nat. size.
,, 3. Anterior view of type. Nat. size.



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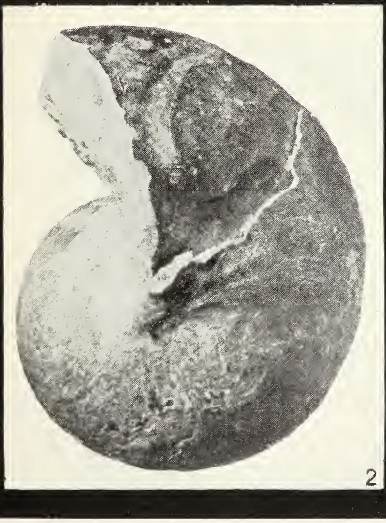

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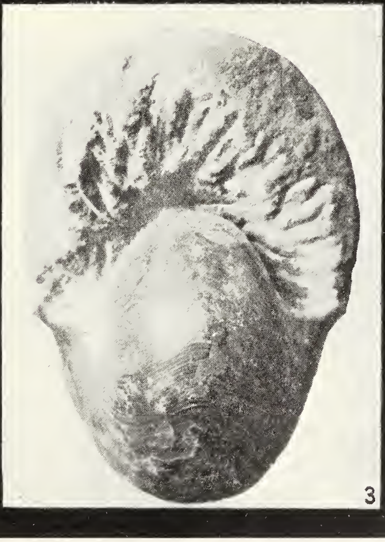

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PLATE II.

Phylloceras Woodsi v. Hoepen.

Fig. 1. Lateral view of largest paratype. Nat. size.
,, 2. Posterior view of same. Nat. size.
,, 3. Lateral view of type. Slightly more than nat. size.
,, 4. Anterior view of same. Nat. size.
,, 5. Lateral view of a paratype. Slightly more than nat. size.
,, 6. Anterior view of same. Nat. size.

Gaudryceras tenuilineatum v. Hoepen.

,, 7. Lateral view of type. Nat. size.
,, 8. Anterior view of same. Slightly less than nat. size.
,, 9. A portion of the anterior view, below the crack visible in fig. 8, enlarged three times, to show the extremely fine ribbing of the external surface.

Gaudryceras varicostatum v. Hoepen.

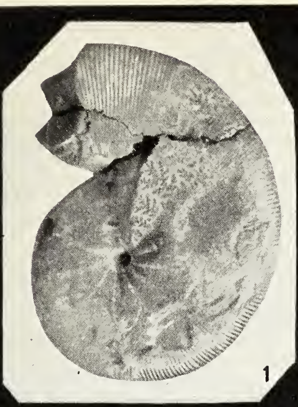
,, 10. Lateral view of type. Nat. size.
,, 11. Anterior view of same. Slightly less than nat. size.
,, 12. A portion of the anterior view, at the beginning of the last whorl, enlarged three times, to show the extremely fine ribbing of the external surface.

Gaudryceras Sigcau v. Hoepen.

,, 13. Lateral view of paratype. Nat. size.
,, 14. Lateral view of type. Nat. size.
,, 15. Anterior view of type. Nat. size.
,, 16. Lateral view of type (the opposite of fig. 14), enlarged three times to show the extremely fine ribbing of the shell.

Tetragonites superstes v. Hoepen.

,, 17. Lateral view of type. Nat. size.
,, 18. Anterior view of same. Nat. size.
,, 19. Lateral view of paratype. Nat. size.
,, 20. Anterior view of same. Nat. size.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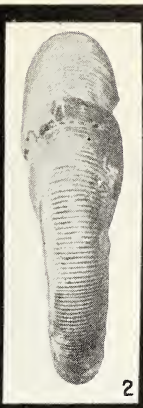
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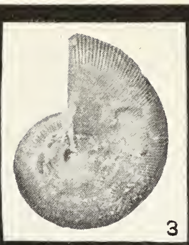
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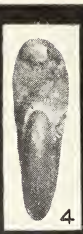
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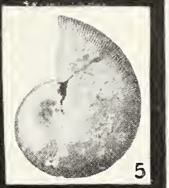
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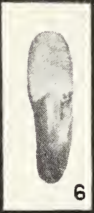
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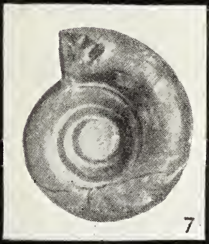
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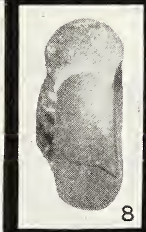
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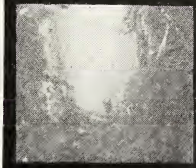
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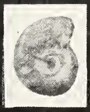
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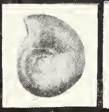
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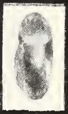
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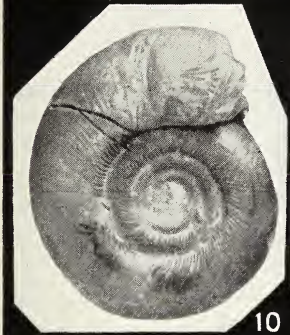
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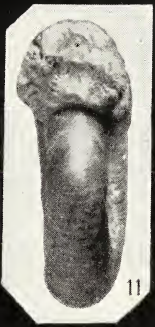
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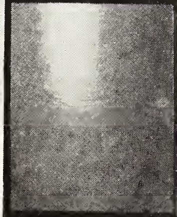
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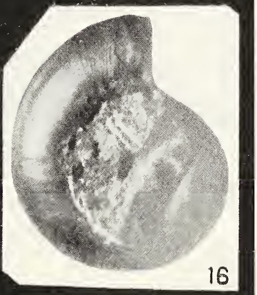
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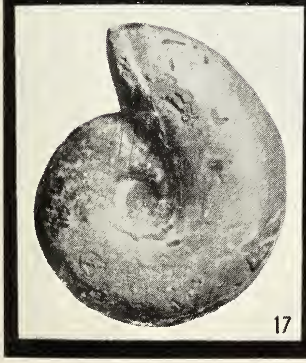
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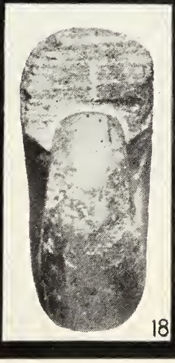
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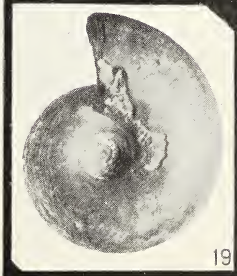
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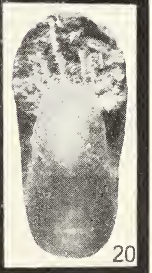
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PLATE III.

Tetragonites virgulatus v. Hoepen.

Fig. 1. Lateral view of type. Nat. size.
,, 2. Anterior view of type. Nat. size.

Tetragonites nuperus v. Hoepen.

,, 3. Lateral view of type. Nat. size.
,, 4. Anterior view of same. Slightly more than nat. size.

Hamites amapondensis v. Hoepen.

,, 5. Lateral view of type. Nat. size.
,, 6. Lateral view of paratype. Nat. size.

Baculites sulcatus Baily.

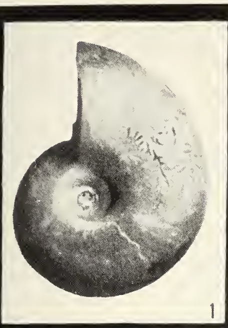
,, 7. Lateral view of plesiotype. Nat. size.
,, 8. Lateral view of another specimen. Nat. size.

Baculites Bailyi Woods.

,, 9. Lateral view of plesiotype. Nat. size.
,, 10. Lateral view of another specimen. Nat. size.

Desmoceras simplex v. Hoepen.

,, 11. Lateral view of type. Nat. size.
,, 12. Anterior view of same. Nat. size.
,, 13. Lateral view of best preserved specimen. Nat. size.
,, 14. Anterior view of same. Nat. size.
,, 15. Lateral view of largest specimen. About nat. size.
,, 16. Anterior view of same. About nat. size.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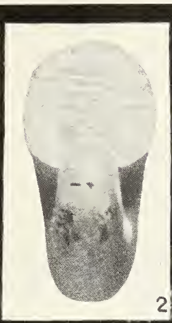
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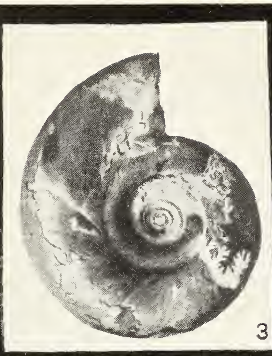
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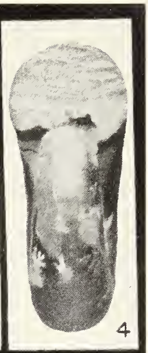
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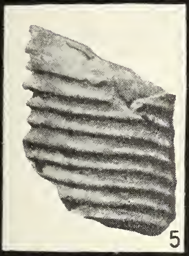
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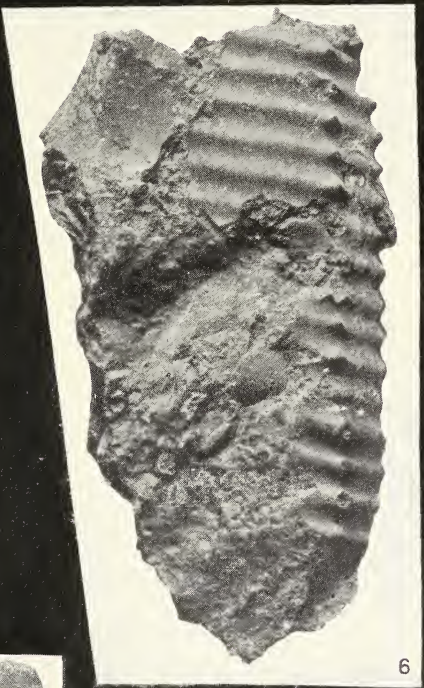
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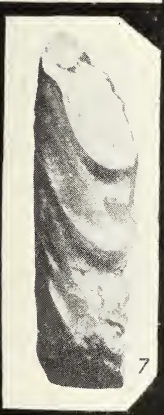
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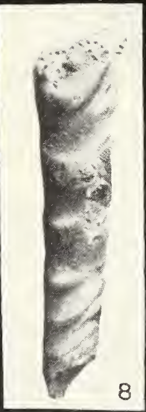
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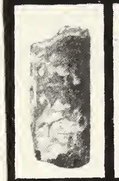
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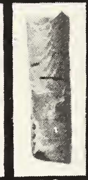
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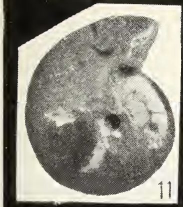
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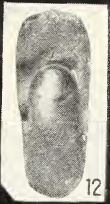
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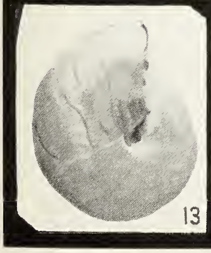
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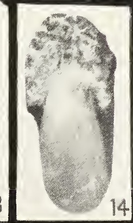
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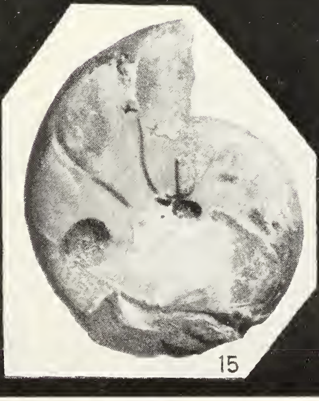
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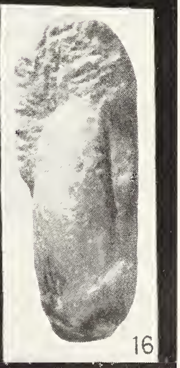
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PLATE IV.

Heteroceras amapondense v. Hoepen.

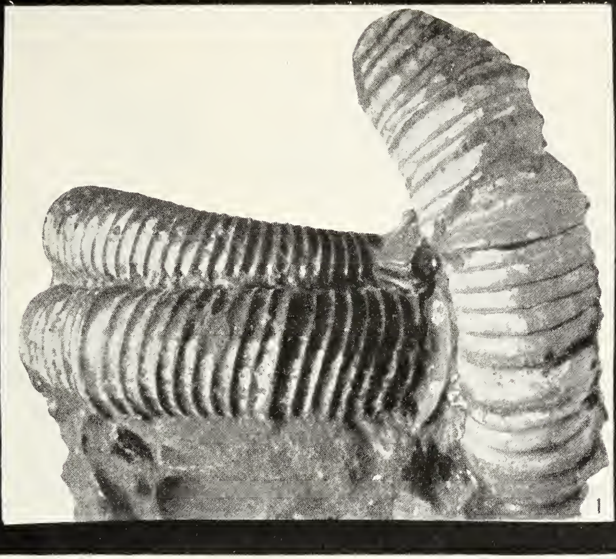
Fig. 1. Lateral view of type. Slightly less than nat. size. The length of the visible portion of the fourth rib from the left in the interval between the two large ribs on the left of the second whorl is 18 mm.
,, 2. Apical view of the specimen. Slightly less than nat. size.

Desmoceras crassum v. Hoepen.

,, 3. Lateral view of type. Nat. size.
,, 4. Anterior view of same. Less than nat. size.

Desmoceras compactum v. Hoepen.

,, 5. Lateral view of type. Nat. size.
,, 6. Anterior view of same. Slightly less than nat. size.
,, 7. Posterior view of same. Slightly less than nat. size.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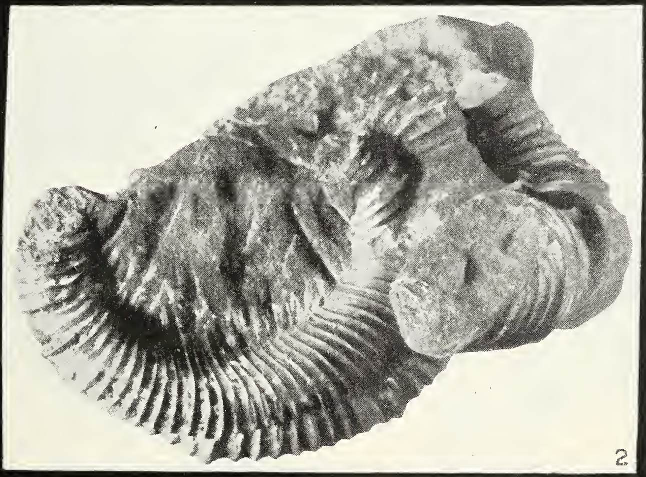
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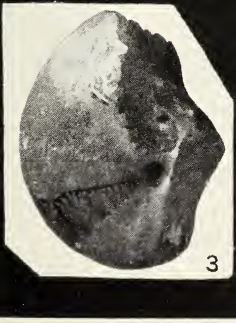
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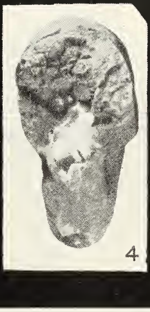
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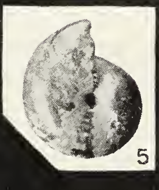
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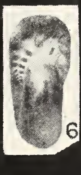
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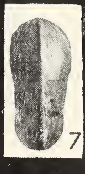
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PLATE V.

Pachydiscus antecursor v. Hoepen.

Fig. 1. Lateral view of type. Slightly less than nat. size.
,, 2. Anterior view of same. Slightly less than nat. size.

Pachydiscus simplex v. Hoepen.

,, 3. Lateral view of type. About nat. size.
,, 4. Posterior view of type. About nat. size.

Scaphites Cunliffei Forbes sp.

,, 5. Lateral view of plesiotype. Nat. size.
,, 6. Posterior view of same. Nat. size.
,, 7. Lateral view of another specimen. Nat. size.

Scaphites sp.

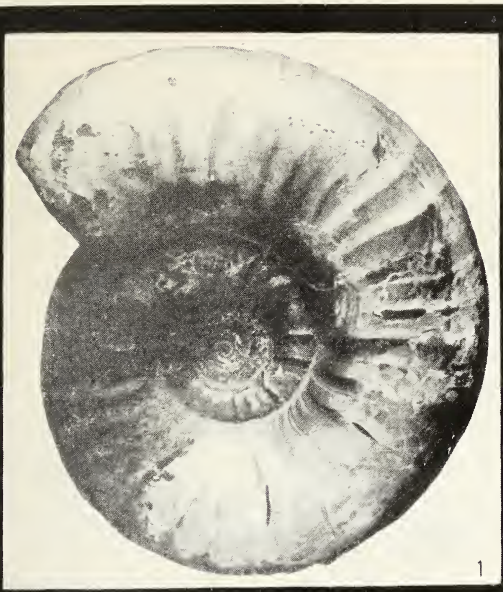
,, 8. Lateral view of one specimen. Nat. size.
,, 9. Posterior view of same. Nat. size.

Pelecodiscus umzambiensis v. Hoepen.

,, 10. Posterior view of type. Less than natural size.

Pelecodiscus capensis v. Hoepen.

,, 11. Lateral view of type. Less than nat. size.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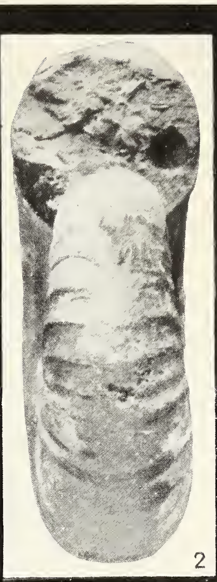
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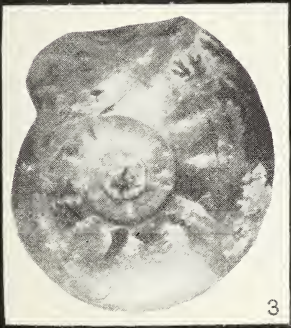
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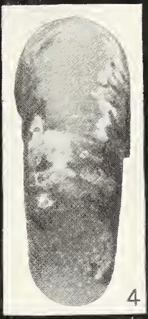
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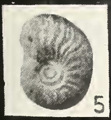
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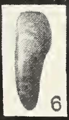
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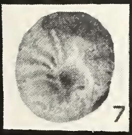
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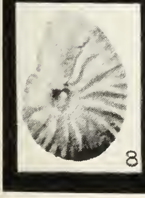
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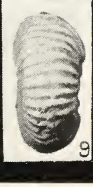
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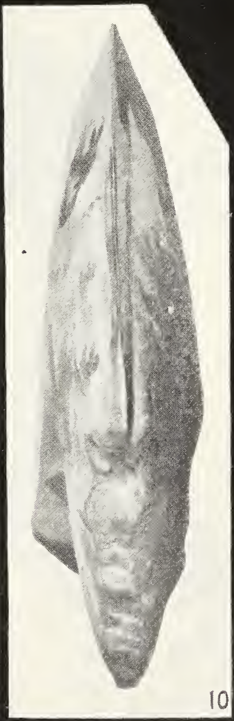
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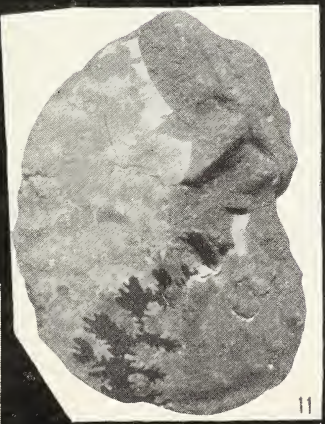
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PLATE VI.

Pelecodiscus umzambiensis v. Hoepen.

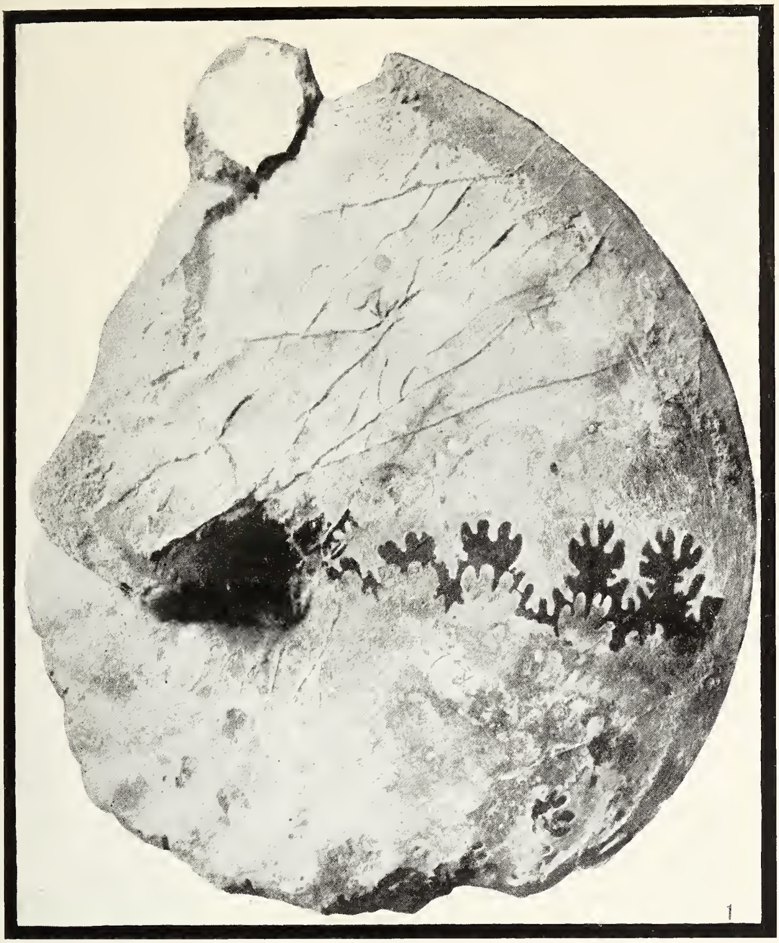
Fig. 1. Lateral view of type. Slightly less than nat. size.

Eulophoceras natalense Hyatt.

,, 2. Suture of the type, reproduced from Hyatt's figure.
,, 3. The suture of another specimen as given by Woods. These sutures are here reproduced for comparison with those of *Pelecodiscus*.

Pelecodiscus Jullieni Pervinquière sp.

,, 4. Suture of the type, as given by Pervinquière.



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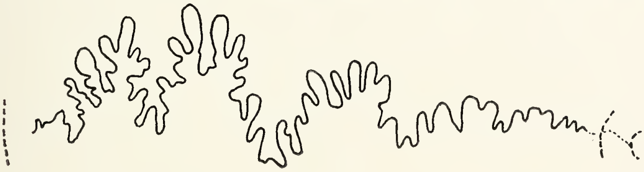

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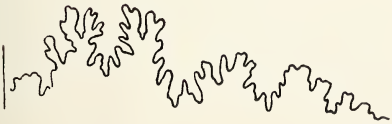

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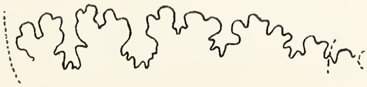

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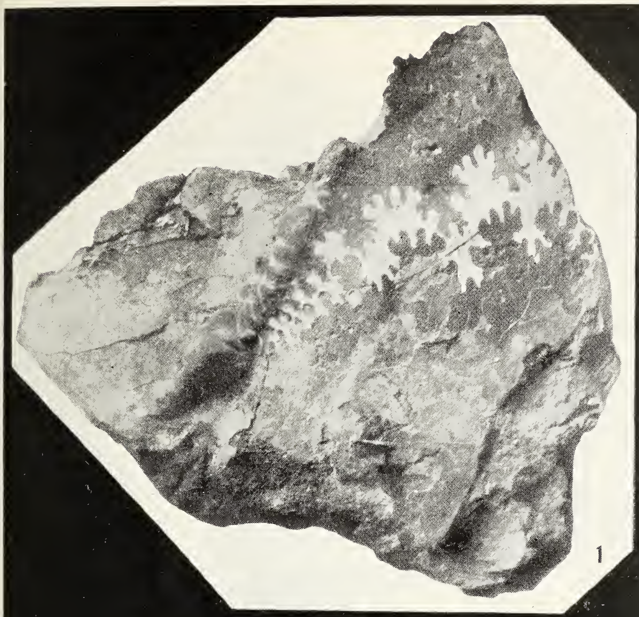
PLATE VII.

Pelecodiscus amapondensis v. Hoepen.

Fig. 1. Lateral view of type. Slightly less than nat. size.
,, 2. Anterior view of same. Less than nat. size.

Schloenbachia Umbulazi Baily sp.
var. *Griesbachi* v. Hoepen.

,, 3. Lateral view of type. Less than nat. size.
,, 4. Anterior view of same. Less than nat. size.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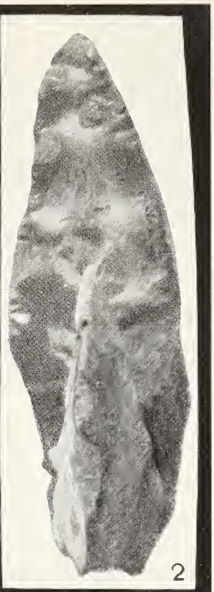
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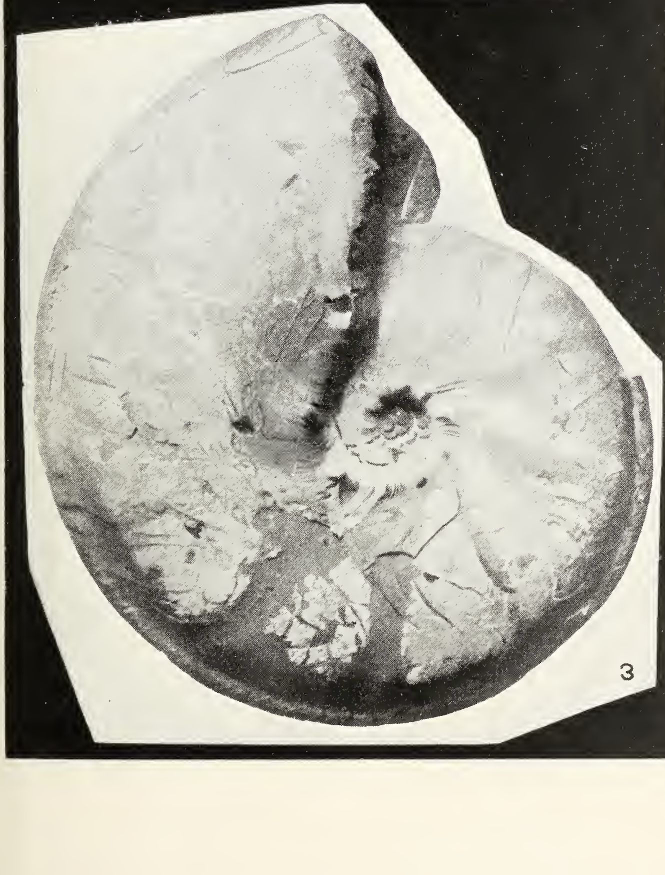
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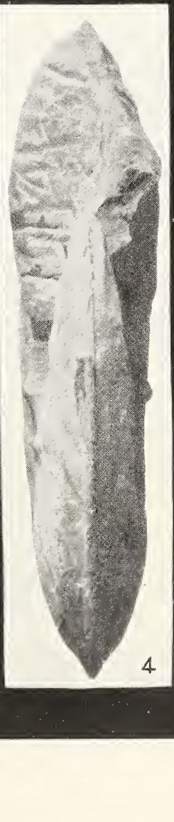
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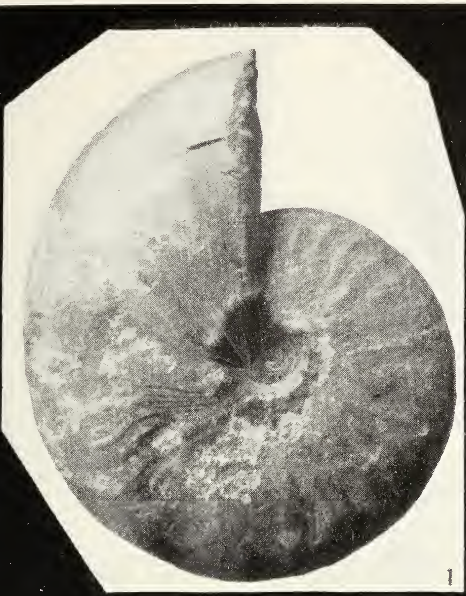
PLATE VIII.

Schloenbachia Umbulazi Baily sp.
var. *Griesbachi* v. Hoepen.

Fig. 1. Lateral view of a large specimen. Nat. size.
,, 2. Anterior view of same. Less than nat. size.
,, 3. Lateral view of a smaller specimen. Nat. size.
,, 4. Anterior view of same. Less than nat. size.
,, 5. Lateral view of a specimen with more conspicuous ribs. Nat. size.

Schloenbachia Umbulazi Baily sp.
forma typica.

,, 6. Lateral view of a thick specimen. Nat. size.
,, 7. Anterior view of same. Nat. size.
,, 8. Lateral view of a thin specimen. Nat. size.
,, 9. Anterior view of same. Slightly less than nat. size.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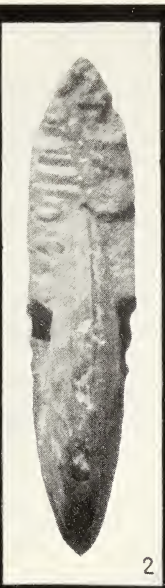
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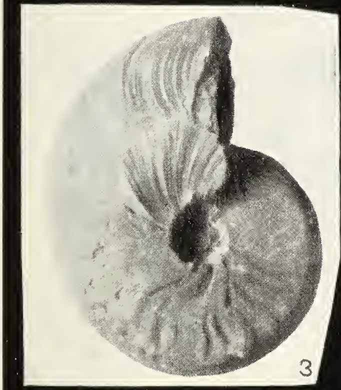
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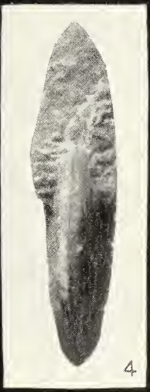
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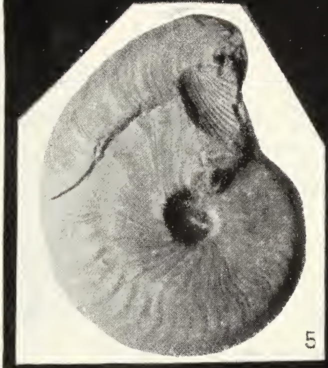
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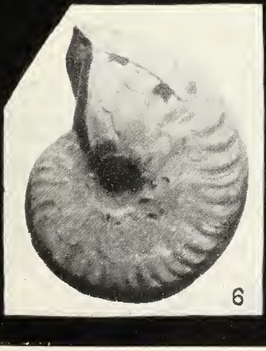
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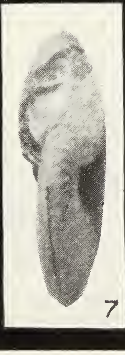
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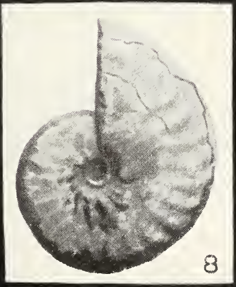
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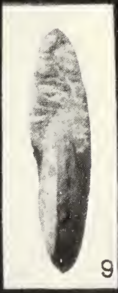
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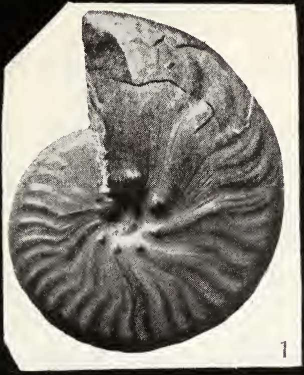
PLATE IX.

Schloenbachia Umbulazi Baily sp.
forma typica.

Fig. 1. Lateral view of neotype. Slightly less than nat. size.
,, 2. Anterior view of same. Less than nat. size.

Schloenbachia Umbulazi Baily sp.
var. *spinifera* v. Hoepen.

,, 3. Lateral view of type. Slightly less than nat. size.
,, 4. Lateral view of a small specimen. Slightly less than nat. size.
,, 5. Anterior view of same. Nat. size.
,, 6. Lateral view of another small specimen. Nat. size.
,, 7. Anterior view of same. Nat. size.



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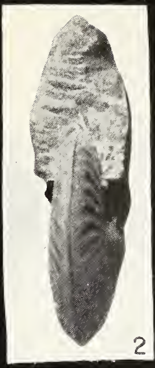

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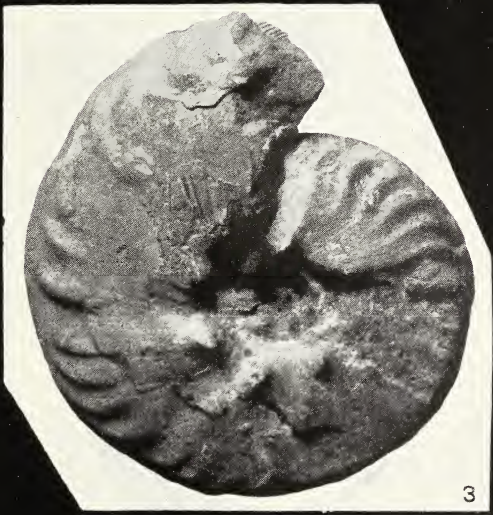

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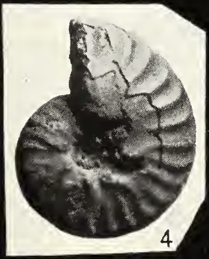

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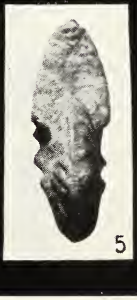

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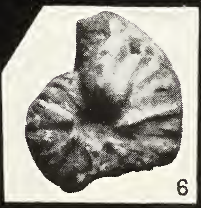

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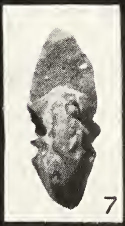

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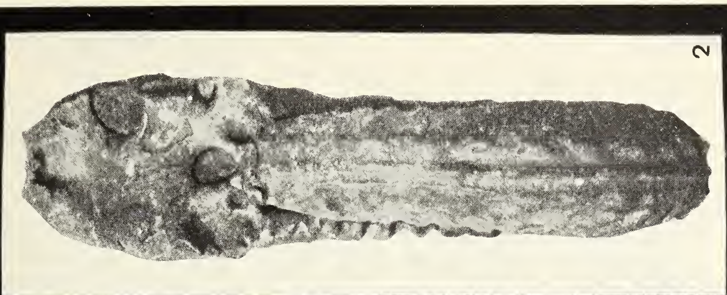
PLATE X.

Mortoniceras Soutoni Baily sp.

Fig. 1. Lateral view of specimen with broad interspaces between the ribs. $\times \frac{4}{10}$.

,, 2. Anterior view of same. $\times \frac{7}{20}$.



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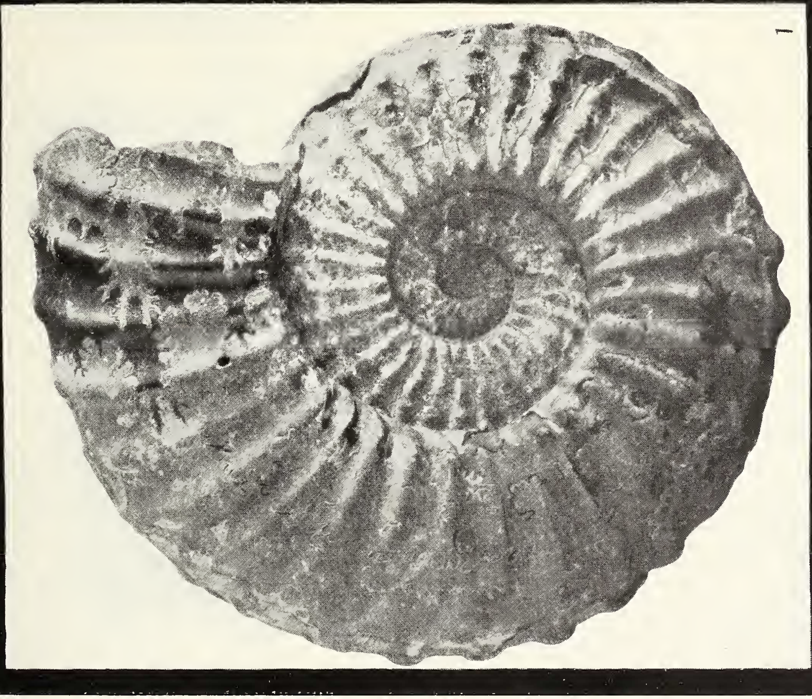

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PLATE XI.

Mortoniceras Soutoni Baily sp.

Specimen with narrow interspaces between the ribs. × $\frac{4}{10}$.